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# FARM ECONOMICS

AFEA-WFEA Annual Meeting, August 27-29

Asilomar, California

*Theme: Agriculture in Economic Growth and Stability*

Proceedings Papers: Joint Meetings of the American  
Farm Economic Association and other Associations

Agriculture in the Nation's Economy .....	John D. Black	223
Prospects for Economic Growth and Agricultural Policy ... .....	Harold B. Rowe	238
World Food and Agricultural Potentialities .....	Charles E. Kellogg	250
The Resources and Performance of Soviet Agriculture Soviet Agricultural Resources Reappraised .....	Chauncy D. Harris	258
Soviet Agricultural Policy After Stalin: Results and Pros- pects .....	Lazar Volin	274
Eye-Witness Appraisal of Soviet Farming, 1955 .....	D. Gale Johnson	287
Discussion: The Resources and Performance of Soviet Agri- culture .....	Otto Schiller	296
Tariff Policy for the U.S.A., A Strong, Rich Country Introduction: Tariff Policy for the U.S.A. ....	Charles P. Kindleberger	309
The Escape Clause .....	Don D. Humphrey	316
Role of Agriculture in a Modern U.S. Tariff Policy .....	Lawrence Witt	320

THE AMERICAN FARM ECONOMIC ASSOCIATION

Volume XXXVIII

MAY, 1958

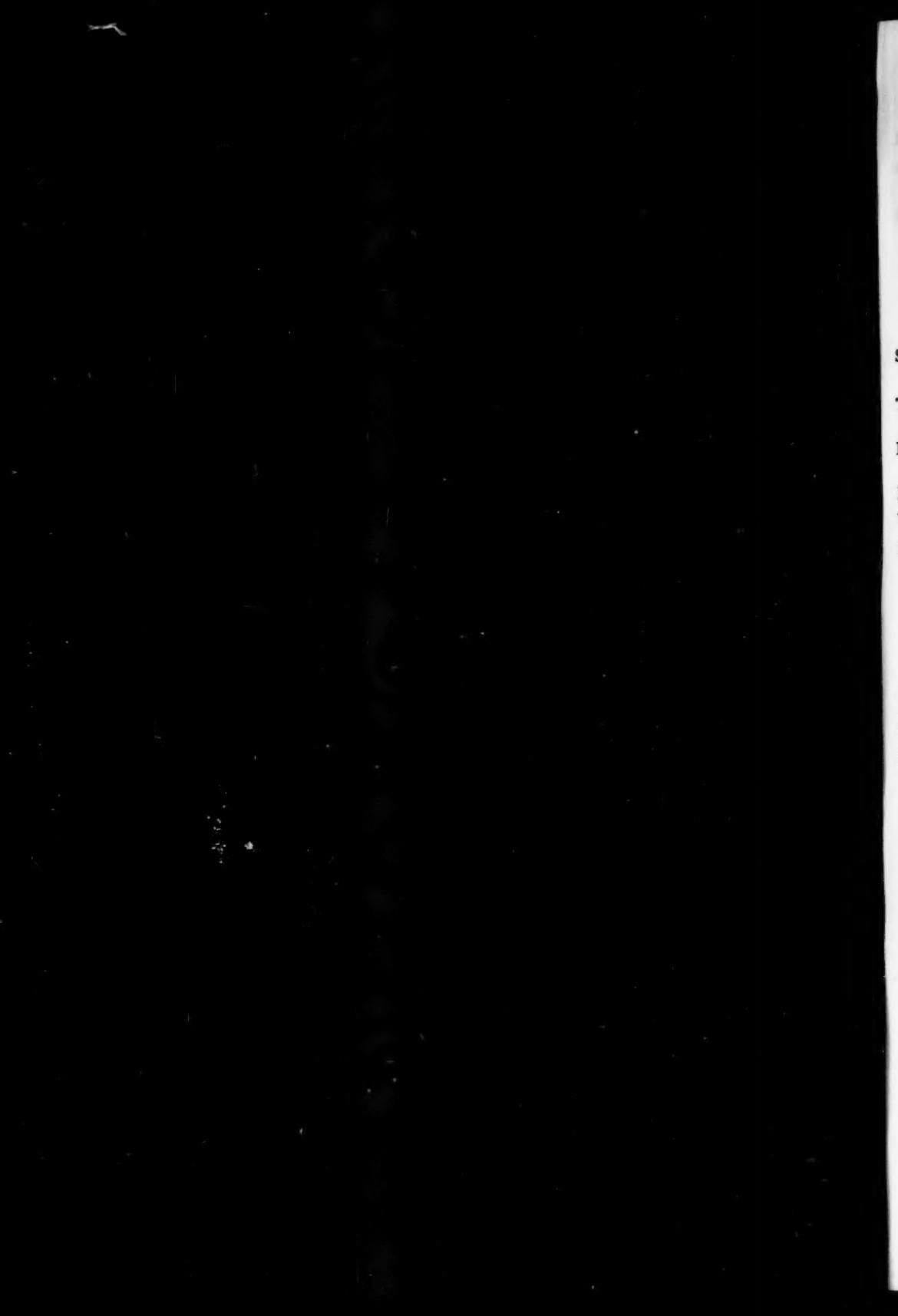
Number 2

Tariff Policy—Hardship Cases and Reciprocal Benefits <i>Richard M. Bissell, Jr.</i>	324
Tariff Policy for the U.S.A., A Strong, Rich Country . . . . . <i>Dennis A. Fitzgerald</i>	329
Canada's Interest in U.S. Tariff Policy . . . . . <i>Donald B. Marsh</i>	333
<b>The Dynamics of Food Retailing</b>	
Movements in the Retail Distribution of Food in the U.S. <i>Robert W. Mueller</i>	336
Developments in Self-Service Food Distribution Abroad <i>William Applebaum</i>	348
Food Retailing and Economic Growth . . . . . <i>Richard H. Holton</i>	356
<b>A Critique of Federal Statistical Series: Index of Consumer Prices</b>	
What Concepts Are Appropriate to Consumer Price Indexes? <i>Irving H. Siegel</i>	361
The Parity Index and the Farm Expenditure Survey . . . . . <i>B. R. Stauber</i>	369
BLS Consumers' Price Index and the AMS Index of Prices Paid by Farmers for Family Living—A Juxtaposition . . . . . <i>Lazare Teper</i>	378
Discussion: The Need for an Expanded Price Research Program . . . . . <i>Laura Mae Webb</i>	390
Discussion: A Critique of Federal Statistical Series: Index of Consumer Prices . . . . . <i>H. E. Riley</i>	394
<b>Application of Mathematical Programming to Agricultural Economic Problems</b>	
Programming Farm-Nonfarm Allocation of Farm Family Resources . . . . . <i>Charles E. Bishop</i>	396
Application of Programming Analysis to Corn Belt Farms . . . . . <i>Earl R. Swanson</i>	408
Solving Feed Problems Through Linear Programming . . . . . <i>I. Katzman</i>	420
<b>Land Tenure Situation Around the World</b>	
Basic Elements in the World Land Tenure Problems . . . . . <i>Kenneth H. Parsons</i>	430
Report on the Land Tenure Situation in Pakistan and India <i>Lee R. Martin</i>	438
Land Tenure Problems in Southern Europe . . . . . <i>Jose Vergara</i>	448
Land Tenure in Australia in Relation to Technical Advances and Closer Settlement . . . . . <i>T. H. Strong</i>	458
Land Tenure in the Philippines . . . . . <i>Joe R. Mothermal</i>	465
<b>Estimation of Economic Relationships</b>	
The Dynamics of the Onion Market . . . . . <i>Daniel B. Suits and Susumu Koizumi</i>	475
Effects of Shocks and Errors in Estimation: An Empirical Comparison . . . . . <i>George W. Ladd</i>	485
Estimates of the Elasticities of Supply of Selected Agricultural Commodities . . . . . <i>Marc Nerlove</i>	496
Discussion: Estimates of the Elasticities of Supply of Selected Agricultural Commodities . . . . . <i>Gordon A. King</i>	509
Discussion: Estimation of Economic Relationships . . . . . <i>Gerhard Tintner</i>	512
<b>Minimum Wages and Other Labor Standards Considered in Relation to Economic Growth in Underdeveloped Countries</b>	
Minimum Labor Standards in Factory Employment in Underdeveloped Areas . . . . . <i>Elmo P. Hohman</i>	513
Minimum Wages and Other Labor Standards in Small-scale and Cottage Industries Considered in Relation to Economic Growth in Underdeveloped Countries . . . . . <i>Jeanne S. Mintz</i>	521

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Minimum Wages and Other Labor Standards in Agriculture Considered in Relation to Economic Growth in Underdeveloped Countries .....	<i>Louis J. Ducoff and Sheridan T. Maitland</i>	529
Labor Standards and Wages in Agriculture in Underdeveloped Countries .....	<i>Egbert de Vries</i>	540
Minimum Wages and Other Labor Standards Considered in Relation to Economic Growth in Underdeveloped Countries .....	<i>John P. Windmuller</i>	543
Minimum Wage Regulation in Underdeveloped Countries	<i>J. Henry Richardson</i>	546

### Contributed Papers

Statistical Analysis of Supply Response in Late Spring Potatoes in California .....	<i>Yair Mundlak and Chester O. McCorkle, Jr.</i>	553
The Impact of the Choice of Model on Measurements of Economic Behavior Relationships .....	<i>E. J. R. Booth and G. G. Judge</i>	
Estimating Yields and Grades of Slaughter Steers and Heifers .....	<i>Emil H. Jebe and Elliott S. Clifton</i>	584
Marketing Extension and Competitive Structure .....	<i>Paul L. Farris</i>	597
Weaners, Yearlings, or Twos .....	<i>C. W. Vrooman</i>	603

### NOTES

A Note on Aspects of Linear Programming Technique .....	<i>M. M. Babbar</i>	607
Member Behavior and Optimal Pricing in Marketing Cooperatives	<i>Hans Ohm</i>	613
More Ado About Sarles' Suppositions Regarding the Interstate Managerial Study .....	<i>Glenn L. Johnson</i>	621
Using the Simplex Worksheet for Linear Programming .....	<i>J. L. Dillon and G. C. McFarlane</i>	622

### PUBLICATIONS RECEIVED

#### BOOK REVIEWS

Howard G. Diesslin, <i>Agricultural Equipment Financing</i> .....	<i>W. D. Toussaint</i>	627
Frank D. Hansing and W. L. Gibson, Jr., <i>Becoming a Farm Owner, Is it More Difficult Today?</i> .....	<i>W. D. Toussaint</i>	628
Allan G. Bogue, <i>Money at Interest</i> .....	<i>Wm. L. Cavert</i>	629
Richard G. Wheeler and John D. Black, <i>Planning for Successful Dairying in New England</i> .....	<i>G. E. Brandow</i>	632
Uses of Agricultural Surpluses to Finance Economic Development in Underdeveloped Countries, a Pilot Study in India .....	<i>Don Kanel</i>	634
Ladd Haystead and Gilbert C. Fite, <i>The Agricultural Regions of the United States</i> .....	<i>Paul W. Gates</i>	637
Harry W. Hepner, <i>Modern Marketing Dynamics and Management</i> .....	<i>Vernon L. Sorenson</i>	638
John Kenneth Galbraith and Richard H. Holton in collaboration with Robert E. Branson, Jean Ruth Robinson and Carolyn Shaw Bell, <i>Marketing Efficiency in Puerto Rico</i> .....	<i>V. James Rhodes</i>	640
Ian Shannon, <i>Rural Industries in the Australian Economy</i> .....	<i>Leo C. Yorke</i>	642
Herman P. Miller, <i>Income of the American People</i> .....	<i>L. John Kutish</i>	644

MEMORIAL, <i>Laurence Joseph Norton</i> .....	648
NEWS NOTES .....	649
DEGREES CONFERRED AND GRADUATE STUDENTS IN AGRICULTURAL ECONOMICS .....	656
PROGRAMME, CANADIAN AGRICULTURAL ECONOMICS SOCIETY MEETING .....	703
CONDUCTED TOUR OF CALIFORNIA AGRICULTURE .....	704
JOINT ANNUAL MEETING OF AFEA AND WFEA .....	705
ANNOUNCING THE 1956 DIRECTORY OF AFEA .....	709

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*Price: \$7 per year, this issue \$1.75*

Entered as second class matter at the post office at Menasha, Wis. Acceptance for mailing at a special rate of postage provided for in the Act of February 28, 1925, paragraph 4, section 412, P.L.& R., authorized November 27, 1931. Printed in U.S.A.

THE JOURNAL OF FARM ECONOMICS is published five times a year during February, May, August, November and December by The American Farm Economic Association. Yearly subscriptions \$7. Published at Menasha, Wisconsin.

# JOURNAL OF FARM ECONOMICS

Volume XXXVIII

MAY, 1956

Number 2

## AGRICULTURE IN THE NATION'S ECONOMY\*

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*Harvard University*

THE analysis distinguishes between periods before 1950 and since. It is important, therefore, to be fully aware of the decline in number of farms by 600,000 between the spring census enumeration of 1950 and the fall enumeration in 1954. This appears to be very close to the actual decline, since the same definition of a farm was used in both counts and as nearly as possible the same enumeration procedure. This is double the decline of the preceding five years and about the same as from 1940 to 1950, if allowance is made for the 150,000 to 170,000 dropped out by a change in the census definition.

The decline in agriculture's share of the nation's economy from 1910 to 1955 is measured in three ways in Chart I. It is greatest from 1910 to 1950 in terms of share of the labor force, from 31 to 10 per cent, or by 68 per cent;<sup>1</sup> only from 42 to 22 per cent, or by 48 per cent, in terms of tangible private assets used in production; and from 16.1 to 7.4 per cent, or by 54 per cent, in terms of Gross National Product (G.N.P.).

\* This paper is a summarization and adaptation of the address of the 1955 President of the American Economic Association at the annual meeting of the Association in New York City on December 28-30. The address is published in full in the March number of the *American Economic Review*, in five sections as follows:

- I. Agriculture in the Nation's Economy, 1910-1955
- II. Projection to 1955 and Beyond
- III. Welfare Aspects
- IV. Problems, Policies and Programs
- V. The Pure Politics of It

Most of the data are from published materials of the Agricultural Marketing Service of the U.S.D.A. and the Census Bureau.

\*\* I received special aid from members of the staff of the Agricultural Marketing Service and Agricultural Research Service, but no one is responsible except myself for the interpolations and extrapolations.

<sup>1</sup> The Census Bureau's series for farm labor force is used here rather than that of the U.S.D.A. It does not include those whose chief activity is off the farm.

Agriculture's share of the G.N.P. was 62 per cent of its share of the labor force in 1951, as compared with 45 per cent of it in 1910. Thus the two shares are coming closer together. One reason for this is agriculture's relatively large and increasing share of the productive assets. In 1951 the average worker on farms was producing with more than twice the tangible assets of the average nonfarm worker. The reason for the slowing up of the decline of agriculture's share of productive assets in the 1930's was the stagnation of the nonfarm part of the economy in the big depression. In the World War II years, agriculture was expanding rapidly and the

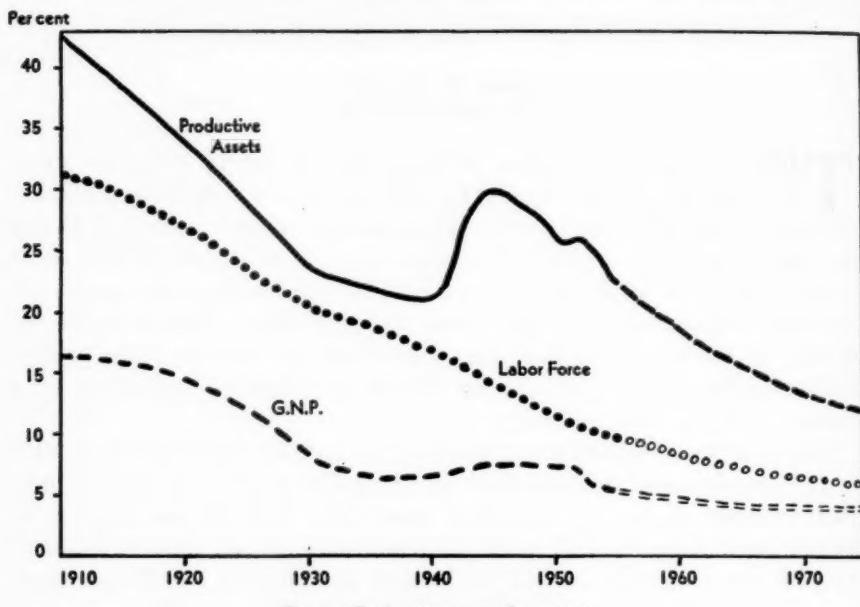


CHART I. AGRICULTURE'S SHARE.

military effort was absorbing much of the nonfarm. The accelerating decline in agriculture's part of G.N.P. in the 1920's was checked by the stagnation of the nonfarm in the depression years. The labor force line shows clearly how labor was dammed up on farms in the 1930's and then drawn off in the 1940 decade.

As a result partly of this larger quota of land, farm buildings, power and machinery, and livestock, used by each worker in agriculture, the output per worker increased greatly, 60 per cent from 1940 to 1955. Other factors were a greater use of fertilizers, commercial feeds, sprays and other supplies, and more advanced technology.

Why does agriculture not have as large a share of the G.N.P. as of the labor force? Before this question is answered it needs to be pointed

out that the difference is not as great as appears in Chart I because the farm-produced farm products consumed by the farm family and the use of the farm dwellings are valued in Chart I at the farm and not at what the farm family would have to pay for them in the city. Any accurate comparison of farm and nonfarm output must put both on the same basis. In a dominantly urban country, this had better be urban rather than farm value. There is also the consumption use of the farm automobile charged off partly as an expense in figuring G.N.P. The difference still remaining arises from the simple fact that farm products are still underpriced relative to other commodities and services. In other words, the terms of trade are still somewhat against agriculture. In an economy shifting from one largely agricultural to one largely urban, even over a span of a century, one would expect a large factor of lag in the adjustment. Never have enough shifted to bring the terms of trade fully into balance. Nor can we be sure that they ever will. It may be that enough families will prefer life in the open country, and particularly being their own bosses on a farm of their own, to keep a margin between farm and nonfarm returns.

In the peak year 1951 agriculture's share of G.N.P. was equal to 62 per cent of its share of the labor force. Since then it has fallen to 56 per cent as a result of the 19 per cent decline in farm prices. This decline has come about as a result of a declining export demand in the face of a 9 per cent rise in farm output since 1951. This creates the dilemma in which the farmers, their public servants and their politicians now find themselves. There is no escape from it except to offset the results of the strong technological surge under way by a rapid extensification of much of our agriculture, that is, shifting it to uses that employ much less labor and some other inputs per acre.

The lower end of the lines on Chart I suggest how much of this we can expect by 1975—to 6 per cent of the national labor force, 12 per cent of the productive assets, and around 4 per cent of the G.N.P. Associated with these changes will be a decline in number of farms to 4 million or less, with 1.25 workers per farm, down from 1.37 in 1950 and 1.82 in 1910. The farm labor force will be around 5 million compared with 7,507,000 in 1950 and 6,583,000 in 1955. Agriculture's share of G.N.P. will be 70 per cent of its share of the labor force, with farm product figured in the same way as now.

These declines, it must be admitted, are all on the conservative side. The now-British economist Colin Clark has projected a farm labor force of only 2½ per cent by 1975, but along with this he says that this nation will be importing half of its farm products in 1975. Clark expects our farms to be almost half deserted by that time. Clark has lived a good part

of his life under a labor government in Australia, under which the central drive was to expand industry more or less to the neglect of agriculture. Those who have lived in this country have been wondering instead, most of the time since 1920, how we can get enough people off the land to bring production into line with demand. We expect to be still working on this ten years from now.

Chart II shows in larger perspective the shift of this nation from dominantly farm to superdominantly nonfarm. After all, Clark's projection (b) is only an extension of the line from 1880 to 1950. The speaker's conservative (a) projection is founded on an expectation that a point will be

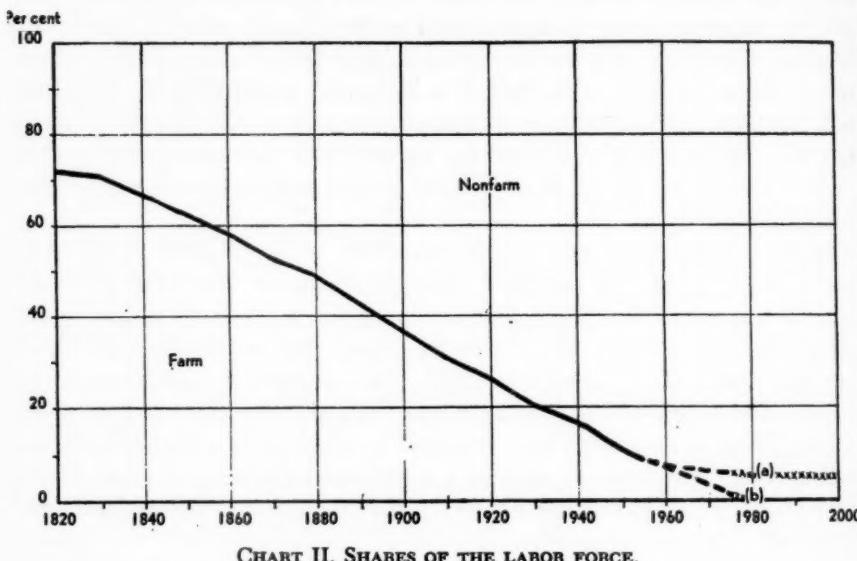


CHART II. SHARES OF THE LABOR FORCE.

reached around 1980 when the number of farms will stop declining and presently begin to increase a little, partly as a result of bringing some land back into cultivation again. He accepts the P.M.P.C.'s projection, adjusted to a population level of 210 million by 1975, of a 53 per cent increase in the demand for farm products from 1950 to 1975. A factor in the change in number of farms will be a relatively small decline in the number of part-time and residential farms.

Perhaps it needs to be made clear that this country will have no difficulty in meeting any demand for farm products that is within the range of present vision. The Soil Conservation Service has classified only 40 million acres of land now in cultivation as needing to be converted to permanent pasture or woodland, and 285 million acres now in unimproved pasture or woodland, mostly the former, as usable as cropland,

mostly in rotation with pasture. At any particular period, sound land use practices will achieve that balance of higher yields on land now in crops and additional land in crops that represents the most economical combination of these two.

The reduction in number of farms will mostly take place, as in the past four years, among the Class V and VI commercial farms with sales of product of \$2,500 or less and acreages from 10 to 70 acres. These farms will enlarge and depend relatively less on hand-labor crops like cotton and tobacco and more on feed crops, pasture, and livestock.

The next question to raise is whether or not the nation should be disturbed because agriculture is becoming so tiny a part of it—only about one twentieth of the labor force by 1975. So far as the economics are concerned, the fewer people it takes to feed the nation, provided they do it adequately, the better off the nation is. Of course this would be true for housing, or transport, or for anything that makes up our living standard.

One constantly runs into attempts to determine how many persons in this country are *dependent* on agriculture. The range in estimates is from about 25 to about 40 per cent. What most people mean is how many have anything to do with the producing, buying and selling, transporting, and processing of farm products, with the food, clothing and other products made from these, and with farm machinery, fertilizer, feed and other supplies and goods used by farmers and their families. It is true that if farmers stopped producing all these people would be largely out of jobs. But farmers are not going to quit producing. They themselves would be the first ones out of a job if they did. The only dependency of those who buy and process farm products is that they suffer somewhat if there is a short crop because of bad weather and the like; they don't suffer if there is a big crop and low prices. They are thus not much dependent on farm prosperity. The only real dependency is among those who sell to the farmers. They lose seriously if farm buying power declines.

But how much does this represent? It is the sum of

- (1) net farm income,
- (2) wages paid farm labor, and
- (3) production expenses for off-farm supplies.

These totaled \$23 billion in 1950, or 8 per cent of G.N.P. This means that if this total should fall off one-fifth in some series of years, something like the equivalent of 8 per cent of the population would suffer a loss of something like one-fifth of their sales to farmers. This is almost the whole extent of this kind of dependence on farm prosperity in ordinary peacetime in the United States.

This can, of course, mean a good deal in small cities out in the open

country. But it will not mean much in cities of several hundred thousand even in the Midwest.

Much more fundamental is another sort of relationship—namely, if agriculture makes progress in turning out better products more efficiently, city folks get the benefit of this in the form of no rise in prices, and perhaps even lower prices. One can see this very clearly in the case of poultry meat and eggs in the last 20 years. The new developments in feeding beef cattle will benefit them in the same way.

But surely larger in dimensions are the increased benefits to farm folks from progress made off the farm. Matched against the more and better foods and fibers that the farms have contributed to city folks are the automobiles and motor transport that the cities have made available to agriculture, the modern power-farming equipment, the commercial fertilizers, modern communication, radio and television, and modern household facilities in so far as they have reached the farms. After all, city folks spend only a fourth of their disposable incomes for food, and more than half the retail value of food is off-farm created. A gain of one-fourth in the on-farm efficiency of food production would mean only a 3 per cent gain for them ( $\frac{1}{4} \times \frac{1}{3}$ ).

But most important of all is an interdependency not yet named. This comes in wartime. The wars in which the United States becomes involved now are world wars, and in these wars the United States has to provide food in large quantities for overseas armies, not just for its own but for those of its allies. Our agriculture must be ready to meet these needs. It wasn't quite ready for this in World War I. It did better in World War II because of surpluses on hand. Then came the immediate postwar years of rehabilitation of our allies. United States agriculture rendered a great service to the free world in 1940-48.

But when the allied countries get rehabilitated there is excess production and sharp breaks in prices. This country cannot maintain an agriculture in readiness to expand as needed during the wars without surpluses at the end of the rehabilitation period. We can do a better job of getting ready for the readjustment than we have. But still we can't let agriculture suffer alone at such times as now. We must help it get readjusted.

The most interesting recent contribution to the question of changing relative farm and nonfarm incomes is a chart in the 1956 *Agricultural Outlook Charts* reproduced here in Chart III. This chart is not on a per capita or per worker basis. It says that in spite of the big decline in agriculture's share of the nation's labor force and productive assets, its aggregate income kept very roughly in line with that of the nation from 1920 to 1948. Part of this unusual effect is due to using the peak-period

years 1947-49 as the base period. If the usual parity base years were used, the farm income line would have appeared to run about 20 points below the present income line from 1920 to 1948.

Let us examine this chart decade by decade:

1910-19: This was a peak period for agriculture, as compared with before and after. Urban wages were low in these years.

1920-29: Wages doubled coming out of the war and industry and trade caught up with agriculture.

1930-39: Industry and trade were stagnant and agriculture only a little

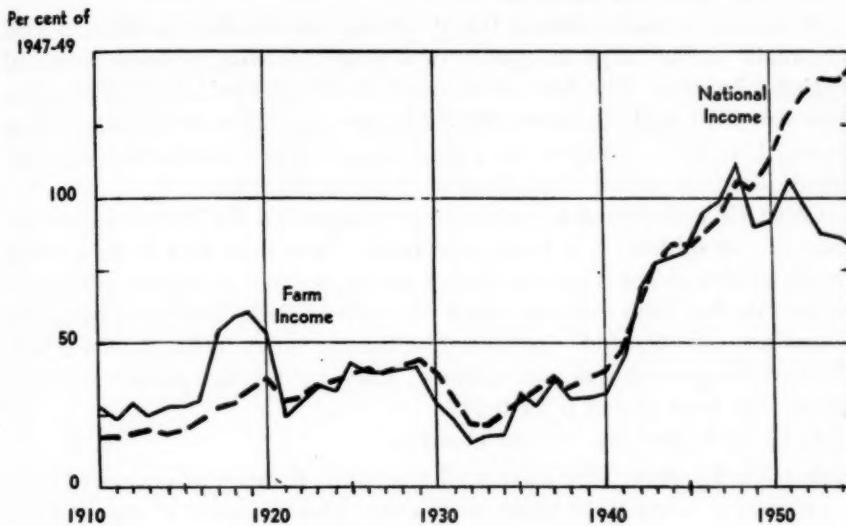


CHART III. FARM VS. NATIONAL INCOME.

worse off. The normal for this decade would have been an extension of the 1920-29 ascending line for national income across the decade to about 65 in 1941, with the line for agriculture rounding off below it at somewhere around 50. This rounding off would have been not because of lower farm incomes, but because of fewer farms and workers.

1940-48: The war and postwar needs for farm products boosted farm income. It would not have caught up fully with national income in these years if the 1930 decade had been normal, but it would almost have done so.

It thus appears that it was a highly abnormal set of circumstances that kept farm income so nearly in line with national income in 1920 to 1948. It was the normal that began to prevail in 1949 and 1950. The Korean War reinstated the abnormal for only a year or so, and the normal is now with us again. In this more normal situation, agriculture must pro-

duce less, and get somewhat lower prices even though the terms of trade are still somewhat against agriculture. In effect only by reducing the size of the agricultural plant by something like almost 10 per cent, or something less than this if new outlets for farm products can be made, can farm prices again start on their way toward a good balance with other prices. There is very great danger that the contraction will not be enough in the next five years and that declines in prices in consequence will really be serious. What is called for is a volume of output that combined with price will give a farm income rounding off on a curve that would have crossed the 1955 line at about 115.

It should be made clear at this point that the declines in 1951 to 1955 are really not as large as appear in a simple plotting of total farm and national incomes. The first series needs to be divided by 600,000 fewer farms in 1954, and the second by the larger population in the succeeding years. This is not done in the recent report of the Conference on Economic Progress called "Full Prosperity for Agriculture."

Chart IV is designed to put in large perspective the business-cycle aspect of our subject. It is being said freely these days that if the present break in farm prices is not checked, a severe business recession will ensue. Some say that farm support prices prevented this in 1949-50. This is the "farm led and farm fed" doctrine. The income totals in Chart IV exclude the civilian government and military. They are for the private economy alone. The base period is 1910-14.

#### A. Consider first the *secular changes*:

Labor has by long odds advanced the most, if labor is measured as a product of labor force times wage rates. This economy of ours has become a wage economy by a wide margin.

Capital's share of the economy measured in rewards has advanced much less than labor's. The decline in interest rates since the 1920's, with dividend and rental rates more or less in keeping with interest rates, has been a major factor in this.

Agriculture's share follows capital's from 1920 to 1948, but at a lower trend rate than in Chart III because of a change in the base period.

#### B. The *breaks*:

In 1920: Only agriculture's broke sharply. This was postwar, the same as 1951-55.

In 1930: Labor's broke the least, in spite of what is considered heavy unemployment. Labor would suffer still less in any future recession because of social security, guaranteed annual wages, etc. Capital's share broke the most and the sharpest. Agriculture's decline was about the same as labor's, but started from a lower level because the 1920's agricultural depression was still not all over.

In 1937-8: In this minor recession agriculture suffered the most because surplus production still continued, production control having begun to fail.

In 1954-5: Labor and capital both recovered strongly from the minor recession of 1954, with agriculture in reverse.

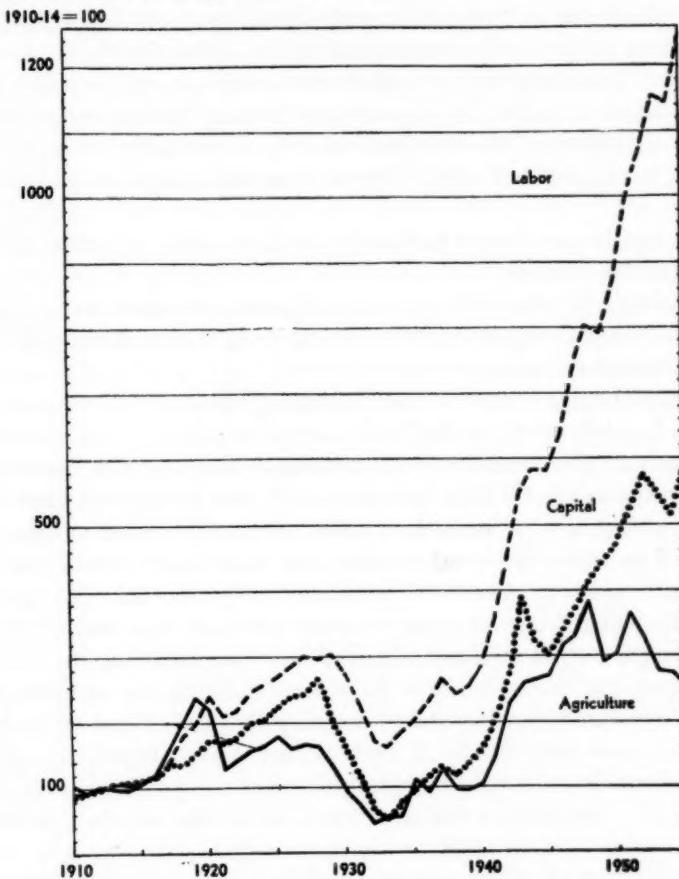


CHART IV. INCOMES—TOTAL.

General conclusions that may be drawn from the foregoing are as follows:

1. Most important of all, agriculture is most affected by wars and post-wars, and least by business recessions. There is little evidence anywhere that business depressions are "farm led." No doubt the loss of farm buying power does contribute a little to a general recession, but very little.
2. The more important interrelation is the other way around. Business

recession causes farm prices to fall. But in 1919-20, and in 1949 and 1952-55, it was loss of export market that caused farm prices to break.

3. The break in farm prices in 1949 was world-wide. Professor Hansen says it did much to check the world-wide inflation still under way. No doubt he is right. But agricultural products are far more important in the world market than in the United States.

The most important thing to point out in considering the policy aspects of our subject is that never before in its history has the nation faced an agricultural situation like the present one, or probably as acute as this one is. The elements of which this acuteness is compounded are as follows:

1. A surge in use of new technology such as never experienced before, and continuing unabated.
2. A similar, but probably not so strong, surge in countries buying from us until recently or supplying the same markets, with a sharp reduction in export demand in consequence.
3. Accumulations of stocks from previous years.
4. The breakdown of production controls largely.
5. Relatively few farmers are in desperate straits as yet, because farm earnings were relatively high in 1951 to 1953, not to mention 1946 to 1948 and earlier. But several more bad years will really create an emergency for several hundred thousand farmers who have heavy debt loads.

The main reason other than weather that production has expanded since 1951 is that the prices that have prevailed, at least until 1955, have made a larger output profitable for the farmers practicing the advanced technologies, and these account for more than half the output of most products. Or the following statement may fit part of the cases better: They lose more individually if they reduce their output, by reducing inputs and yields or acres. Prices supported at the present slowly declining levels may not change this situation in any large way in the next few years.

The imposition of acreage controls alone apparently does not change this situation importantly with most crops. When fewer acres are planted, they are the best acres. More fertilizers and pest controls are used, etc. With marketing quotas, the excess acres are shifted to other crops, to corn in the South, to grain sorghum in the West. This adds up to a larger expansion of livestock than of cash-crop production, and direct price supports and production control are difficult or impossible for most livestock products.

The only really effective and workable program for the next few years would appear to be to put a floor under farm incomes at a relatively low level, but one that would keep most farmers from losing their farms if

nothing else were done for them, and let prices of the different products drop to a level that will clear the market in 3 to 5 years, with the aid of:

- (a) A stepped-up school feeding program stressing livestock foods.
- (b) An expanded program of getting more of these same foods consumed by families on relief and low-income families generally.
- (c) Larger exports possible because prices are no longer supported above world market levels in this country.
- (d) An expansion of economic foreign-aid programs, with the aid taking the form of shipments of farm products to be used in these countries to put otherwise unemployed or underemployed persons at work on village aid and other development programs in these countries. This will represent *additional consumption* in these countries.
- (e) A "soil bank" program administered as an expansion of the present agricultural conservation payment program, with a large expansion of the combination program—larger than is now being planned in administration circles. This is the most direct way of achieving an extensification of our agriculture.

The income supports in these years should be in the form of compensatory payments making up the difference between the market prices resulting under the foregoing and prices varying with the size of the current crop or output in such a way that the *net return* from a large crop or output of any product is a little less than from an *average* crop, so that there will be no premium on a larger output. These compensatory payments should be limited to the individual farm quotas in the case of farms under acreage or market quotas. It should be clear that such a program of compensatory payments is very different from the Brannan proposal for them. The cost of it will of course be very much less, and it will be on a descending scale year by year.

It surely will cost less than price supports at a rigid 90 per cent of parity level, besides offering much more hope of coming part way, at least, to an end. Nothing more unreal can be conceived than saying to farmers after they have marketed a big crop at high prices: "Go ahead and grow another big crop. We guarantee you the same price as this year's." This is the very method we used to get expanded production during the war. Is 90 per cent of parity a high price? It surely is in the present supply-demand situation.

At the very start, the present levels of "flexible" prices at "modernized" parity may serve to determine the size of the compensatory payments; but as soon as possible some new ones should be worked out that fit the foregoing definition product by product.

It will also be important—if it proves to be necessary in order to prevent many foreclosures of farm mortgages and other loans—to develop some

emergency program for carrying these over the next five years, much as was done in the years of the big depression of the 1930's.

This program will need to be kept in operation, at least on a standby basis, over the next ten years at least, before our farm output is brought into reasonably good balance with demand at home and abroad.

In the meantime some longer-run programs will need to be extended or developed. Most of what is needed in the longer run comes under the head of *stability* for agriculture. By stabilizing agriculture, we do not mean keeping it at a constant level, but rather keeping its growth and development steady. Of course, the major part of this problem by far lies outside of agriculture. If there were no wars or business cycles, however, there would still be the following: first, the production cycles for hogs, beef cattle, dairying, and the like, the quick ups and downs in poultry farming, and probably some long sweeps in orchard fruits; second, the overexpansion that commonly comes with a burst of new technology in a line of production, and necessary leveling out or contraction following; third, the rather sudden shifts in demand due to new developments in the market, such as margarine's substituting for butter, and artificial fibers for cotton and wool, or due to loss or gain of foreign markets. Given continuing wars and business cycles, a good part of the problem for agriculture is adjusting itself to them, expanding just enough at the right time and way, and then contracting afterwards.

It should be apparent that the measures outlined above can be adapted to fit the need for expansion as well as contraction. They surely can be used to check overexpansion due to new technology, or to bring about adjustments due to loss of markets. In spite of full awareness of the hog-corn cycle for forty years, however, there is evidence of very little headway in controlling it. Indeed, real success along any of the lines just listed will call for a more vigorous and determined effort than has thus far been made, except in the case of wartime expansions. The first part of such an effort is over-all current analysis to see what is ahead and the adjustments needing to be made, for the nation as a whole and by regions and major types of farming. Much progress has been made along these lines in the past ten years. The second part is reducing this to terms of adjustments needed on representative or modal-type farms in different sections of each state, so that those working with the farmers in these sections will know each year in what direction the farming needs to be heading so that it will fit into the pattern of needed change. This should be a joint undertaking of the agricultural extension service, the soil conservation districts, the Farmers Home Administration, the production credit and the farm loan associations, the farm foresters, and all tied into the new farm and home development program. The staffing of the exten-

sion service for its major role in this effort is highly inadequate. About four times as much extension effort is now going into technology of production as is going into planning needed adjustments and implementing the plans. Also, much more production economics research is needed as a foundation for this farm planning. Such research is rarely more than one-tenth of the research of the state experiment station. The result is that the agriculture of most of the nation is well out ahead with technology to increase yields and to make the land more productive, but poorly equipped with the know-how of harnessing the knowledge and putting it to such use as will make it contribute as effectively as it might to better life on the farm and to a more orderly serving of the needs of the rest of the nation.

Finally, and most important of all, a successful handling of the foregoing two problems will not help much the lower-income third of our farm families except in one important particular, namely, that a steadily advancing economy with reasonably full employment will provide employment outside of agriculture for more of these families or members of them. Much of what is being said and written on this problem these days is largely in terms of this solution. What they propose in effect is to depopulate and abandon these low-income areas as has been done in the past in much of the Northeast. Yet the bold truth is that our country has grown to the point where in another generation it is going to need to have much of these low-income areas in agriculture and forest-crop production. Moreover, as has been pointed out earlier, any contribution that the improving of agriculture in these areas is going to make to surpluses in the next five years is so small that it can be ignored. The other important factor in this situation is that the technology of farming the land in much of the low-income area of the United States has been developed to the point where all that is needed to have good income is to practice this technology on farms of sufficient acreage. The cost of bringing very much of this land into the uses suited to it—dominantly hay and pasture—and of employing the new technologies is far less than that of reclaiming new land in the regions of scanty rainfall.

The rational program for these low-income areas is therefore to help the better farm families among them to take over the land being abandoned by the rest and thus enlarge their farms as needed, and at the same time to improve their present land plus that acquired, and to apply the new technologies to it. What is required for the long-overdue reconstruction of the agriculture of the low-income areas is primarily a much expanded program of helping the farm families in these areas to work out plans for developing the resources already in their farms and for buying additional land if this is needed, and then credit in the right terms. It

will be mostly intermediate-term credit or real-estate mortgage credit. In either case, the loans should be of the budgeted or open-end type so that the loans can be enlarged year by year in the earlier years and then paid off year by year later. The necessary private and public agencies to furnish this credit are already in existence, but the Farm and Home Administration needs much larger financing than in the recent past. An extra pair of extension workers is needed in each of the low-income counties to specialize in the planning work on their low-income farms.

At the same time, the provision of education and medical services for these areas needs to be much improved. To tax the incomes of our city population to help provide this better education and health for areas that are going to provide many of their future citizens is not in the least unreasonable. Such education and health aids, plus access to modern communication, will presently help greatly in keeping down the size of families in these backward areas. The improved education and communication will facilitate migration.

The foregoing is far from a full outline of the needed program for agriculture. Credit financing is needed for other than low-income farmers, particularly for young men ready to start as farm operators—the “future farmers of America,” upon whom depends the quality of the farming in the next generation. Also our leasing systems need to be revised so as to make it advantageous for both landlord and tenant to conserve and even improve the farms that they jointly operate.

It will not take long to present the main political aspects of the problem with which we are dealing. What was conceived as an adjustment program around 1930 and was embodied in large measure in the act that Congress passed in 1933, called the Agricultural Adjustment Act, was transformed more and more into a price support program from 1938 on. Many thousands of persons still living heard President Ed O’Neal of the American Farm Bureau Federation tell on one occasion or another how he once said to Sam Compers, the great pioneer labor leader of this country, “Sam, you have had great success in organizing labor to work for its own interest. I am starting out to help farmers as you have helped labor. Haven’t you some good advice to give me?” “I surely have,” said Sam, “The American Federation of Labor is interested in much more than wages for its members. But it does not stress these other things. We pick out one thing, simple, that everybody can understand, wages, and fight hard to raise them. You must do the same.” Ed O’Neal then asked, “I suppose then that you would say that higher prices for the farmer is what the Farm Bureau should fight for.” “I surely would,” said Sam. And this is what the Farm Bureau did in those years.

No doubt a sizeable fraction of the farmers of this country realize pretty

well that our government cannot keep on supporting prices on a level that brings forth growing surpluses. But many of these will say if asked, "Labor is grabbing all it can get. Business always has been able to get pretty much what it wants. If we farmers don't grab the same way, we are being silly."

In this confused situation, there is a fair chance that rigid 90 per cent price supports will be voted in either in 1956 or 1957. The U.S. Department of Agriculture that has the task of administering such an act will be in a worse spot than the present Department of Agriculture is in now. It will be dramatic injustice if it is not a Democratic administration that has to take on this task. Such a course of events will simply mean that bad as things seem now, they will have to get worse before the rank and file of the people of our nation sense the situation well enough to take the necessary action. The party in power at the time they sense it will lose a good deal of standing with the general public in the ensuing five or ten years.

As for the final outcome, we need have small fear. But as a nation we will be better off and less distraught in the next five years if such a program of action as here outlined can be set forth upon as early as in the coming Congress.

It should be evident by this time that the education in the public affairs of agriculture that is needed in order to obtain constructive action without too long delay must not be limited to farm people. The other 86% per cent—before long 90 per cent or more—need an understanding of these affairs too. They will at times need to come to the rescue of agriculture. This coming Congress and election may be such a time.

## PROSPECTS FOR ECONOMIC GROWTH AND AGRICULTURAL POLICY\*

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**G**RWTH in a nation's economy is reflected in sustained increases in population and in product per person, with associated changes in levels of living. Although it has received a great deal of attention, the study of economic growth is still at a stage in which speculation and tentative formulations are permissible. Conclusions should be stated with caution and perhaps not taken too seriously.

### I

I suppose everyone could agree that economic growth has important implications for policy and for agriculture. Probably it is also safe to say that such growth begins with agriculture.

We can visualize a primitive situation in which all activity would be confined to family units completely isolated from each other. Necessarily, each unit would be self-sufficient and hence agricultural in character. Its enterprise would be limited to responsibilities for decisions regarding the use of available labor and other resources. These would amount to choices among the expectations of benefits attached to the alternatives that might be recognized, for example, choice of the final benefits expected from immediate consumption instead of the expectations associated with the recognized production alternatives. Presumably, such choices would be influenced by uncertainty of expectations for the future, as in restricting current consumption in order to store something extra against unforeseen needs. Possibly productivity could be increased through the exploitation of additional resources, development of new techniques or skills, accumulation of capital equipment, and specialization among members of the unit. To this extent, levels of living could improve or additional people could be supported, but these gains would be limited to individual families.

Removal of the isolation restriction, perhaps by discovery of some means of communication, would open the way for trade among units. The range of possible choice for each unit would then include additional alternatives for transformation through exchange and for further specialization in production. Advantageous choices among these opportunities should result in increases in productivity throughout the trading community far beyond anything attainable by the members in isolation. This would evidence economic growth.

\* Address given at the dinner of the American Farm Economic Association, New York City, Dec. 28, 1955.

The process of growth is activated by enterprise decisions among the known alternatives for commitment of resources to transformation in production and exchange. These decisions are made on the basis of expectations that relate to the future and are necessarily uncertain.

Growth is conditioned by, and in turn influences, the evolution of institutions. Hence, the long-term expansion of trade has not been independent of the development of institutions of private ownership of property rights, contracts, debt, money, banking, and in fact the whole institutional organization of business. Most features of modern markets may be viewed as having evolved through custom and organization to meet needs that arose as trade increased. Both voluntary association and governmental action have contributed to the establishment of grading standards, the provision of reliable services of sampling and inspection, the extensive development of market information and the improvement of communication. In the aggregate, such developments have greatly reduced imperfections that limited primitive markets. The benefits of this improvement of markets are realized as increased supplies of desired goods and services. They are secured through the organization of production in operating units that can obtain the benefits of specialization and can exploit the advantages of scale and technological advances.

## II

At some stage in the evolution of institutions of law and government, matters of policy arise in the sense that they are identified and appear in public discussion. In a later period, such as we are in at the present time, the public is confronted with a bewildering range of policy problems, objectives, proposals, and statements. Even when attention is limited to the area of economic policy, or a restricted segment of that field, statements of problems and declarations of policy are encountered in legislative enactments, pronouncements by high officials and releases from numerous agencies at various levels of operation. Any, or all, of these may be significant and furnish appropriate topics for study. But for the study of general policy, and certainly for a discussion of agricultural policy in relation to economic growth, there is a concept that is broader and more important than anything that can be derived from official statements.

Policy in this broader sense is best formulated as an interpretation of the whole pattern of relevant action and inaction in terms of final net effects. The conditions of any period, including those generated through the process of economic growth, present a range of alternatives or opportunities for public action. The leaders who make the decisions of government, like their counterparts in private enterprise, may recognize these

alternatives or overlook them, interpret them correctly or incorrectly, and act on, or ignore them. Again, the decisions arrived at may be thought of as based upon expectations as to the outcome in the future. Decisions with respect to many diverse lines of action produce a complex pattern of economic effects. It is the resultant of all these effects, interpreted in relation to the problems presented by prevailing conditions, with which we are really concerned.

A reliable statement of policy in this sense ordinarily cannot be obtained directly from public documents. Hence, the public economic policy for a past period may be stated on the basis of, first, an interpretation of the opportunities or challenge—in short, the task—presented by conditions of the period, and second, conclusions regarding the net effects of government action and inaction. Both, of course, are subject to review and revision as further knowledge regarding the dynamic functioning of the economy is developed, additional evidence becomes available and historical perspective changes. The later verdict may be, of course, that problems were erroneously identified and that public action produced effects opposite to those expected.

Meaningful appraisal of current policy is in effect a projection, or if you prefer, a forecast. It requires a conception of problems in advance, not in retrospect. It also requires the evaluation of expected future effects in a growing economy. To say the least there is an element of uncertainty involved.

If we are concerned with the process of economic growth, such interpretive appraisal of policy is important. Growth is influenced in many ways by government actions and failures to act. Because of this influence, agencies of government are sources of innovations and organization developments just as truly as are private units. Hence the decisions of government also may activate economic growth. Like the decisions of private enterprise they reflect the recognition of alternatives and the valuation of uncertain expectations regarding future outcomes.

### III

As interest in the study of economic growth has increased, considerable attention has been given to the problems of developing improved and longer-range projections of future potentials and prospects. In the general effort to clarify these problems and obtain a better basis for decisions and appraisals, a number of careful projections have been made. Perhaps the most obvious comment that can be made about these is that each one seems to be revised upward by the next. In recent years, expansion has been phenomenal and usually has exceeded even the most extreme advance estimates.

In the light of the information we have, it now seems probable that the United States has developed abilities and institutions that generate fairly continuous economic growth. Certainly, the potentials for future growth are very large, and there do not appear to be any insurmountable obstacles to our realization of these potentials at about our previous average rate. On the whole, it appears reasonably possible that the Gross National Product (in terms of 1953 dollars) may exceed \$600 billion by 1975, and it is not at all difficult to develop a projection as high as \$700 billion.

Like others, I hasten to add that we may not actually reach any such level of output. This is not because I desire to stress the errors in forecasting, but because I wish to emphasize the kind of uncertainties that should be taken into account. Perhaps the greatest of these relates to the possibility of a major war that would upset all previous computations. For the present, I am inclined to think in terms of continued international tensions and cold war that will have variable economic impacts. But this outlook could change at any time.

Population projections are uncertain within considerable limits, largely because of inability to predict changes in birth rates. The latest census projections of total population for 1975 range from a low of 206.9 millions to a high of 228.5 millions. As a convenient midpoint, I have used 215 millions, which closely approximates the projection computed assuming that birth rates will continue near present levels for the next ten years, and then decline linearly to about 1940 levels by 1975. But there is no reason to say this is more probable than either of the other projections.

Similar uncertainty relates to the question of how people will elect to distribute their time between work and leisure. Taking into account the age distribution of the present population, current levels of spending, and obligations already undertaken, it is suggested that for the next several years there may be: (1) only comparatively small reductions in working hours, (2) some further entry of women into the labor force, but (3) a fairly tight labor supply because of the relatively small current annual additions of young people and the tendency to remain in school longer. In the second decade, however, larger numbers of young people should enter the labor force, and I should expect a decline in average hours worked. Census estimates also indicate that by 1975 the number of people 65 years old and over may exceed 20.5 millions compared with slightly more than 14 millions now.

Further uncertainty, of course, arises in projecting future technological advances both for agriculture and for other parts of the economy. I have no reason to doubt that we can have a continued flow of technical innovations with the high rate of capital formation required to put them to

use. Moreover, there is evidence that changes that have been taking place in agriculture and elsewhere considerably accelerate the rate at which technical improvements are adopted. Hence, I feel confident that productivity will increase from this source and quite possibly at an increasing rate. On the other side, the rate of advance could be checked significantly by a shortage of technicians and scientists, most probably because of deficiencies in precollege training.

Finally, there can be no certainty that we shall maintain stability at a level of reasonably full employment. There are a number of things that argue against a severe depression within, say, the next ten years, but this is only the first half of the period with which we are concerned. On the whole, it seems to me that the greatest single danger may be a continuing economic and political bias toward inflation.

#### IV

Excellent work has been done on various aspects of the question as to what such growth prospects mean for agriculture. This has included the development of several long-range projections of consumption and output for farm products. There are differences among these, of course, in part because of their projections of growth for the total economy, especially in relation to the population variable. Other differences seem to be caused by variations in estimates of income elasticity of demand for food and the probable further increases in agricultural productivity. It is not possible here to review these, and I shall not attempt significant extensions or refinements. My own views may be slightly less conservative than some other computations, but would not be significantly different from the results of work reported by the Agricultural Marketing Service and the Agricultural Research Service and frequently referred to in the recent outlook conferences.

Subject to all the uncertainties involved, I accept as a reasonable possibility that the aggregate value of farm products consumed and exported in 1975 may exceed the present level by perhaps 40 to 45 per cent. This, of course, would involve an increase of more than one half for livestock and poultry products. Although the largest gain should be made by forage-consuming livestock, feed requirements would be large. Fruits and vegetables should also rise more than in proportion to population. Per capita domestic use of fats and oils and cotton might remain about the same, but would be expected to decline for several other important products in line with past trends.

I also share the view that these requirements can be met within the environment of general growth that has been suggested. This would mean total production slightly more than one third above the present level

and very large shifts among products. Probably the greatest pressure would be on feed supplies, especially the high protein feeds. On the other hand it would appear that supplies of fats and oils might be excessively large in relation to the outlets presently in sight. In the absence of technological developments that permit a larger domestic use of these products, greatly increased export outlets would be needed. Somewhat similar difficulties might develop with respect to fibers.

The adjustments indicated may not come easily, but I see no necessary physical or economic limitations on the ability to accomplish them. Obstacles that cannot be surmounted are most likely to have their origins in the areas of domestic politics and international relations. On the whole, I feel that we need not be especially alarmed about our agricultural production potentials twenty years hence, but neither should we be unduly complacent.

Appraisal of issues, problems, or opportunities of public economic policy, in relation to such growth prospects and from the general point of view I have tried to suggest, is subject to obvious limitations. Development of dynamic analysis is far from complete, and there is not much that we can be certain of about the causal relationships that generate long-term economic growth, even when we describe the way it occurs. Moreover, the final effects to be expected from particular public decisions are difficult to evaluate in advance, and appraisals of results produced by past actions are by no means complete or beyond controversy. In these circumstances, interpretation of problems or opportunities and conclusions as to what the government ought or ought not to do are especially vulnerable to the influence of beliefs based upon unreliable impressions of historical changes, intuition regarding "self-evident" principles, or incomplete and inadequately tested formal analysis. Perhaps defects attributable to such influences will be present in the remainder of this discussion. However, I am conscious of at least some of the dangers, and my objective I believe is moderate. It is merely to review a few of the more significant and presently recognizable elements of our national agricultural policy and to illustrate some of the growth implications that can be suggested. This cannot be either detailed or complete and some grouping of course will be necessary.

## V

Perhaps there is sufficient agreement regarding several general elements of our evolving policy so they may be enumerated with only very brief comments. First among these would be the over-all pattern of activities bearing upon the maintenance of reasonable stability, high level of employment, and continued growth for the economy as a whole. Only

as these purposes can be achieved for the nonagricultural sectors can there be the increases in demand for products and outlets for the surplus resources from agriculture that would be necessary to a substantial realization of growth potentials within agriculture. At the present time, these goals are emphasized in current official declarations and proposals. On the whole, it seems to me this emphasis is fairly well borne out in actions and programs. But this is an opinion regarding the net resultant of a pattern which includes weak as well as strong features, with certainly some inconsistencies and outright contradictions. For example, we can hardly claim to have at the present time a foreign trade policy that is consistent with optimum long-term growth. Moreover, effectiveness in maintaining stability in production and prices has not been fully tested, and I have already indicated my own inclination to stress the dangers of a general bias towards inflation.

Somewhat overlapping the preceding group would be a large category of public services that must expand with general growth. Improvements in highway, school, and health facilities are obvious needs, but many others are involved. Examples could include such divergent matters as police protection, public recreation facilities, market services, or disease and pest control activities. For this discussion, it should be sufficient to note merely that they cover a wide range of problems that will continue to be important.

I presume also that we can recognize, rather than fully discuss at this time, the whole area of research and education. This of course is not to belittle its significance or relevance to our general topic. Every serious consideration of long-term growth must recognize expansion and dissemination of knowledge as probably the most important factor that can be identified. Surely we can agree that public support and encouragement of research and education has contributed immeasurably both to our gains so far and our potentials for the future. I think of nothing else that more clearly merits approval as an element of both agricultural and general policy than a continued development of such support. But critical exploration and appraisal of details lies far beyond the scope of this review, except as a few implications may appear in the consideration of other specific topics.

Somewhat more difficult to state briefly and clearly are the comments I would make on programs for nutrition and health, market expansion, and security against emergencies, viewed as problems of agricultural policy. With respect to the first, there can be no doubt that improvements in nutrition and health represent gains in levels of living of a character that should be realized in advanced stages of economic growth. Also, I do not question the propriety of directing public action at the solution

of problems identifiable in this area. Both education and measures of direct action are warranted. But I have recurrent doubts about the possible distortion and misdirection of effort that can result from emphasizing these as features of national agricultural policy. The health services available to many people are below minimum standards we can well afford to accept at our present stage of growth, but these include urban as well as rural residents. Also, our average diets are fairly good in relation to reasonable standards of nutrition, and these diets can improve further as incomes are raised. To be sure, many families have deficient diets that are well below the average and should be brought up. But there likewise are problems of overeating among those who are above average, and educational efforts at the very least should be directed at both kinds of problem.

On the specific matter of school lunch programs, genuine gains have been made. The most important of these gains, I think, have been in demonstrating the feasibility and value of improved diets for school children. There is every reason to believe that these gains can be maintained through local support, so there appears to have been a permanent contribution toward the conservation and development of human resources. So long as unmarketable stocks of food have to be acquired, waste can be reduced somewhat insofar as they can be used in school lunches. Hence it would be foolish to ignore the significance to agriculture. But for the longer term, and especially in relation to the objective of sustained economic growth, I cannot help but feel that additional public resources might be used more profitably—for example by attempting to improve both the quantity and quality of instruction in the public schools.

I have somewhat similar reservations about the merits of sponsoring research and promotions for the specific purpose of expanding outlets for agricultural products. I realize that this is not a matter of all black or all white. Research of this character basically may be no different from other research and such promotions are not always easy to differentiate from educational activities that could be approved without significant reservations. Nevertheless, it seems to me the real objective should be an efficient allocation of public resources, and I doubt whether this is aided by concentrating upon the expansion of outlets for particular products as a problem of policy.

Under the heading of security against emergencies, I have in mind chiefly the matter of adequate food and feed supplies in the event of war or serious crop failure. The first of these is a major uncertainty and both suggest problems of real policy significance. On the whole, I have no reason to predict that either will diminish over the next twenty years,

except that some additional cushion will be provided if per capita consumption increases with further growth.

Here as elsewhere I have no final answers to the questions involved. However, I do question the merit of extreme proposals for the maintenance of large reserve stocks against such contingencies. With a high level of consumption and a reasonably normal functioning of the over-all food market, most variations in production can be absorbed at costs substantially under those of a reserve stocks program. In the event of a major war emergency, even very large reserves cannot provide full protection. But observation and study of past experience indicates that really large reserve stocks at the outbreak of war are most likely to be dissipated in considerable part through wasteful use and the postponement of unpleasant adjustments. Moreover, with the large shift to grass and forage-consuming livestock that seems to be indicated, soil fertility and other reserves that could be exploited through emergency adjustments should build up rapidly. On the whole, policies contemplating reliance upon such possibilities, along with the maintenance of moderate reserves within the marketing system, appear most promising in relation to the prospects for a fairly long period ahead.

## VI

Turning now to some problems and issues of policy more directly identified with the situations of individual rural families, there is first of all the matter of underemployment. I agree that involuntary underemployment or unemployment is a general problem, not one specifically relating to agriculture. I also agree with those who suggest that underemployment and consequent disparities of income develop in the process of economic growth. Finally, I concur with the view that locational aspects of growth probably account for the existence of numerous areas in which many families are stranded in substantial underemployment and poverty. This may happen to small- and moderate-sized urban communities, but it is especially important for a large number of rural people.

For such families, both urban and rural, there are important problems of providing income protection and assistance in conformity with standards that have been accepted. In this connection I agree with those who point out that the problems of rural poverty have received far too little attention, since most of these families produce little for sale and hence have not received significant benefits from the major programs for the support of farm prices and incomes. But the important basic problem is one of effectively employing these people where they can begin to share in the benefits of continuing growth. Hence it is imperative that relief

measures be of a character that facilitate, or at least do not hinder, movement into advantageous employment.

The big limitation, of course, is largely one of mobility. Education is an obvious need—not particularly as training for employment, but as the most effective means of raising standards, developing an awareness of available alternatives, and overcoming unwillingness to seek, or even accept new employment. I feel quite certain that compulsory military service has provided a kind of education and experience that has helped a great many young men break through these barriers in recent years while there have been so many employment opportunities. The tendency for current industrial expansion to decentralize through the location of new plants in or near some of these surplus labor areas also appears to be a favorable development of major importance. It should greatly increase the opportunities for nonagricultural employment within those immediate communities. In general, the prospects for growth offer exceptionally favorable opportunities for continued progress in dealing with these problems, especially over the next several years. Even so the shifts are very difficult, especially for older people, and progress is likely to be spotted. How far the problems are solved within the next two decades will depend in part upon the scope and effectiveness of the measures that are adopted.

Next I suggest that while the outlook for long-term growth favors further progress in the reduction of involuntary rural underemployment, voluntary partial retirement may increase. I have previously noted that the age distribution of the population is such that a large increase in the proportion of older people seems inevitable. This change in proportions will be greater for the rural population, because the movement to urban centers is mostly by young people. Hence, there should be a greatly increased proportion of older people who may find underemployment or partial retirement, on farms that appear inadequate by commercial standards, preferable to either a change of occupation or readjustments of the kind that would be necessary to ensure full employment. Furthermore, there is a real possibility that greater numbers of people from other occupations may seek partial retirement on part-time and residential farms. Higher incomes, substantial retirement and pension benefits, as well as the virtually certain overcrowding of recreational, resort, and alternative retirement facilities, all would favor this development. Moreover, it is still true that there can be important income advantages in this kind of retirement. Of course, all such ventures are unprofitable from the point of view of the efficiency-minded analyst or accountant. But in appraising these situations it is well to bear in mind that an investment of savings in a part-time farm that is so unprofitable that losses eat up the entire prin-

cipal by the time of death, still leaves a person's estate in the same condition as would an equal investment in the purchase of a lifetime annuity. Moreover, rural semiretirement generally offers greater opportunities for "do-it-yourself" additions to income or recreation and usually affords better protection against the hazards of inflation.

Quite distinct from the problems of involuntary rural underemployment and partial retirement on part-time or residential farms, are the adjustment problems of commercial agriculture. For the immediate future, these are likely to be acute. Over the longer period, they will not be easy of solution and the process of adjustment probably will be continuous. This indicates that they merit continuing attention in research and education. Personally, I agree with the view that emphasis should be upon ways of reducing cost and assuring high level output for the future. Beyond this, any attempt at constructive comment would require the examination of specific types of situation and would be quite impossible in a summary review. On the whole, I am optimistic about the prospects for accomplishing the needed adjustments over the longer period, with chief reliance upon the incentives provided by competitive markets.

## VII

Finally, there is the group of programs involving direct government efforts to support agricultural prices and incomes. These were initiated as antidepression and adjustment measures, covered by detailed and persuasive official declarations of policy. Among those who worked in the early development of these programs were many able people who sincerely believed they were instituting a policy of assisting needed adjustments in commercial agriculture. By late 1938 or early 1939, however, events showed rather clearly that the adjustment feature had been lost.

I cannot see that any really significant new feature has been added, or that these programs have changed much in their basic character, since that time. To be sure, the relative emphasis upon different features has varied and details have been modified. New terminology has appeared and rationalization has been revised. Hence, essentially the same programs have been justified in relation to stated objectives of curtailing production, conservation, increasing production to cover wartime requirements, and promoting stability. From the point of view I attempted to state at the beginning of my discussion, this group of activities now constitutes the most prominent element in our agricultural policy.

I have deferred until last my comments on this element of policy, mainly because I do not believe the activities, either individually or as a group, can be considered compatible with the requirements of long-term growth. I do not know what levels of prices and incomes will

prevail as we realize our growth potentials in whatever degree we actually do. I would expect that sharp adjustments, variation in crop conditions, or other developments, might give rise to problems that warrant public attention. But over the longer period, levels of price that are appropriate to growth will depend upon factors I cannot predict. If developments increase the production of farm products more rapidly than demand expands, resources will need to be transferred out of agriculture and the terms of trade will be adverse. On the other hand an opposite relationship could appear.

This does not mean that incomes of commercial farms would need to be low after appropriate adjustments had been made. Periods of growth commonly reveal illustrations of declining prices associated with profitable operations that are made possible by cost-reducing techniques and adjustments in organization.

I am reasonably certain that appropriate adjustments cannot be achieved through acreage diversions or marketing quotas of the type we have had in the past. I am equally certain that continued price support pursuant to a policy of getting more for farmers in good times and bad is not consistent with the realization of our potentials.

In this connection, of course, the parity formula has no economic validity. Certainly if we are to realize our prospects for further growth, price relationships should change. The parity standard has been modified in recent years in ways that give it a small degree of flexibility. Even so, it tends to project historical relationships between the levels of prices for agricultural versus nonagricultural items, and among the prices for individual farm products, after they have become obsolete because of economic changes. Hence, the parity formula defines price relationships that are not consistent with sustained economic growth.

## WORLD FOOD AND AGRICULTURAL POTENTIALITIES\*

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ESTIMATES of world agricultural potentialities can be approached from several points of view. The problem is so complex that it must be broken down into smaller units, by countries and groups of countries, and into smaller functional pieces. Yet we know that what happens in any one country depends on the questions of war or peace and of stagnation or prosperity in other countries.

We can try to limit our inquiry to the basic physical and biological potentialities for abundance. What kinds of soil do we have, what will they produce, by what means, and how much? The results of such inquiries suggest that we still have great unused soil resources.

Although we need to start with such raw data they do not tell us very much about actual potentialities within the real world we see around us. Agricultural production results from management applied to the soil. We cannot say that it is primarily due to the one or primarily to the other. Some kinds of soil are not suited to production of food and fiber under any known system of management. Many soils are clearly suited to such use, but yields vary widely, even several fold, according to management. Then too, a large part of our soils are essentially useless for crops as we find them in their natural state but can be made highly productive with the skillful application of capital inputs.

Above all, we must continually recall that our agricultural production, whatever it is, results from millions and millions of decisions made by individual farm families all over the world, using many hundreds of thousands of unique kinds of soil.

A few years ago my associates and I suggested some rough estimates of potential world food production (*in Food, Soil, and People*. UNESCO, Food and People, Ser. No. 6, 64 pp. New York. 1950). We reached the conclusion that by assuming the general use of practices already being used by good farmers occupying the various kinds of soil the acreage of cropland could be increased by a little over 50 percent, say from  $2\frac{1}{2}$  billion acres to about  $3\frac{1}{2}$  or 4 billion acres. Although a part of this increase lies in the temperate or cool-temperate region, such as the United States, Canada, and northern Europe, most of it lies in the Tropics, especially in South America and Africa and in some of the larger islands. In the Peace River Country of northern Alberta alone a

\* Paper given at a meeting of the American Economic Association, New York City, December 28, 1955.

large additional acreage be developed, around 10 million acres and perhaps 20 million acres. In the United States we could find another 100 to 200 million acres. Actually we have not developed much new cropland since World War I, because it was not economic to do so.

Now we are taking around one-half million acres of good agricultural land annually for urban uses so that it is lost to agriculture in perpetuity, even though we have plenty of other land for such uses. I should like to say parenthetically that this is a serious matter from a long-run point of view. It has not seemed serious to American people, even to our agriculturists, because we are now in the midst of such a revolutionary increase in agricultural efficiency on the acres already in use.

Interpretations of the estimates made in 1948 about potential world production led me to the conclusion that food production could be increased substantially beyond requirements simply by extending to all soils in use the results now being obtained by the better farmers using the various kinds of soils. For cereals, root crops, sugar, and fats and oils the potentials far exceed the needs. More effort would be required to meet the needs for fruits and vegetables, meat, and milk. Even though these estimates were made only nine years ago, we have had phenomenal increases in the efficiency of agriculture since that time. In other words, by going through the estimating process now, we should probably get higher figures for potential production today because of the improved management now being followed by the better farmers, not only in this country but in several other countries as well. This is to say nothing about the prospects from research results already reported but not in general use and from those not yet reported.

If instead of these assumptions, we should make a calculation of crop potentials at the level of management followed by good farmers in Holland for the temperate regions and on plantations in Hawaii for the Tropics, the estimates would be far greater. I repeat that these estimates take no account of the new techniques that are coming along so rapidly. Right now, for example, one agricultural worker in the United States produces twice as much corn as one worker did only fifteen years ago.

Such estimates tell us only that we have the raw potential in our soils to supply food and fiber for a much larger world population. But these soil resources are not distributed evenly. Western Europe has little new soil to exploit; in fact, agriculture is losing some land to urban uses. Although the United Kingdom, and especially France and Ireland, could make substantial increases in yields, northern Europe as a whole cannot be expected to make great net increases. China, India, and Pakistan have relatively little new land to exploit but yields could be increased and especially efficiency in terms of yields per worker. It is hard even to spec-

ulate about the Soviet Union. It has great soil resources, but it also has, generally, an erratic climate. Practices could be improved enormously with more capital inputs on farms. But instead it appears that for some time capital has been drained away from agriculture to heavy industry. One has little basis for guessing the future trends.

In countries like China and India current production could be increased, certainly, but such increases may call for almost revolutionary improvements in land tenure, management skill, and the availability of agricultural supplies, especially machinery, chemicals, and power.

I should like to emphasize the relationship between agriculture and industry. In our own country we have gone from about 75 percent of the labor force in agriculture, during the first decade of the last century, to about 10 percent at the present time. And the figure will drop some more. The social consequences have been very great. Now our industry is so large that it is relatively easy for agriculture to have the steel, chemicals, and power required without curtailing other uses.

Parenthetically, I can only mention, without discussing the details, the problem of water. This is rapidly becoming a scarce resource. A great deal of discussion and legislation can be expected during the next few years about the conservation of water and its allocation among competing users.

But to return to soils: Most of our most productive soils in humid regions were not so naturally; they have been made productive by techniques developed through science and by the use of the power and materials of industry. The Corn Belt no longer has a monopoly on high corn yields. In fact, we are little concerned here in the United States any more about the natural fertility of our soils. By fertility, I mean the amount and balance of plant nutrients. We are now much more concerned with the physical condition of soils—their structure, depth, and water relations. Given light and temperature, a soil with good physical structure is so responsive to our modern methods of fertilization and water control that "inherent" or "native" fertility is becoming relatively unimportant to the skillful manager with capital at his command. We are not only getting high production from such soils, we are getting it very efficiently.

But without industry to furnish the power and materials, without skillful managers, and without capital, many of our most productive soils would be essentially useless for agriculture at anything like current prices and current standards of living.

I am trying to say that countries like the United States and Canada could increase their agricultural production very greatly, and do it efficiently, with only modest economic incentives. Ultimately water may

become the limiting factor in large parts of our country, in the East as well as in the West.

Despite the large potentialities capable of immediate development in temperate countries, my studies lead me to believe that the greatest long-run potentials are in the Tropics—in Africa and South America, and on several of the large tropical islands. Perhaps I should say very long run, for most tropical areas are now lacking many of the basic institutional elements that have made agriculture in Western Europe and America so prosperous: competent research and advisory services, reasonable and secure land tenure for farm families, basic education for the rural population, capital, and an industry to serve agriculture.

We must also recognize the dense farm populations of such areas as southern and southeastern Asia that press on the limited soil resources with few alternative opportunities; the common lack of medical facilities; the social customs among people that hinder the adoption of many scientific principles and techniques; and the intemperance of racial and political conflicts among people in several places.

These are all very serious handicaps to optimum soil use and agricultural production because they limit the management skills that farmers practice. My own confidence that the soils in these areas have great potential abundance is based on the few bright spots where such handicaps have been at least partly overcome.

One realizes, of course, that all these handicaps need to be worked on; and they are being worked on in several countries.

Perhaps one of the greatest of the handicaps to agricultural progress is the lack of appropriate agricultural research institutes and services. Herein lies a great challenge to technical assistance of the "Point Four" type. Basic scientific principles can, of course, be transferred from temperate regions to the Tropics. So can many engineering techniques. But not the field techniques of soil management. The soils and other growing conditions in the Tropics are too different from those of temperate areas. In fact, a major responsibility of experienced tropical agriculturists is to protect the soils of the Tropics from the common tillage and cropping practices used by the best farmers of the United States!

Let me take one example from the humid Tropics: Unlike temperate regions, the most productive soils are found under the forest. Native farmers clear the forest and grow their crops for a short time. If cropping is continued the soil soon becomes exhausted of plant nutrients and the savanna grasses invade the fields; then the natives abandon them and clear new fields from the forest. Commonly, the season is dry for a few weeks each year; the savanna burns; and the forest never returns. Millions of acres of such anthropic savanna exist in the Tropics. With fire control

and return of the forest, enormous areas would again have productive soils.

Some form of this system of shifting cultivation goes on in the Tropics under many names. Where cropping is carried on to the point of near soil exhaustion and invasion of persistent savanna, shifting cultivation is wasteful and highly inefficient. But it does not need to be so wasteful. By stopping the cultivation and returning the soils to forest before exhaustion, productivity may be restored for another crop. Such restoration forest is called "forest fallow" or, more commonly, the "bush fallow." Thus shifting cultivation may be wasteful or not, depending on how it is employed.

Empirical field research in the Belgian Congo has shown that a regular system may be used to maintain soils at fairly good levels of productivity by laying out the village lands into corridors. The number of corridors depends upon the years necessary for the bush fallow to restore the soil after an optimum sequence of mixed crops. Thus maize, upland rice, bananas, and cassava may be grown in a mixed culture; the crops are harvested one after another over a period of three or four years; and the soil is returned for 12 years under the bush fallow. On such a soil 16 corridors would be needed, with one being cleared each year and one returning to forest each year.

The forest is used in another way to maintain soil productivity: Many food crops and such industrial crops as cacao and coffee are grown amidst the trees with only partial clearing of the forest.

Systems involving the bush fallow require a lot of land and a lot of labor. If we knew exactly what the bush fallow does to the soil, perhaps we could find ways to improve it or even, on some tropical soils at least, to substitute other combinations of practices that would be more efficient. We know that the trees bring up nutrients from the lower soil and concentrate them in the surface. We know that a balance of nutrients in the soil is critical, including the trace nutrients used by both plants and animals. We know that shade is important. We suspect that water relationships are important. The relative significance of these factors varies with the local kind of soil. The plain fact is that we do not know exactly what the bush fallow does. For my own part, I should rather know the answer to this question than that of any other unanswered question in soil science. The results affect millions of acres and millions of people.

On a large part of the soils where the bush fallow system is used, clean clearing, plowing, and seeding to a single crop, as farmers do in the Middle West now, leads to serious soil depletion and commonly to erosion down to a sterile lateritic hardpan.

I do not mean to imply that all soils in the Tropics need to have the

bush fallow. A few productive alluvial soils, which receive fresh fine rock material from annual flooding, may be used for rice, cotton, sugarcane, and other crops with only modest fertilization. But these are small areas. Relatively young soils from basic volcanic rocks, and those that are occasionally refreshed by basic volcanic ash, can be handled somewhat the way soils are handled here in the United States, except that most of them occur on moderate to very steep slopes.

Rubber or oil palm may be planted in the partially cleared forest and the "nursery" trees gradually removed as the rubber trees or oil palms become larger. Or a forest may be cut and planted to bananas with the bananas shading the young trees or palm seedlings and the soil under them.

There are other exceptions. In fact it is very hard to generalize about tropical soils. There are more locally contrasting kinds of soil within the Tropics than in all the rest of the world.

But the point I wish to emphasize is that for many tropical soils we now have an uneasy choice among some system of bush fallow, mixed forest and crop plantings, or ordinary rotation farming with exhaustion of the soil and the great risk of its complete destruction.

No research is more badly needed than that to establish the precise actions of the bush fallow. With such knowledge I am confident that we could improve the fallow or perhaps substitute combinations of fertilization and other practices—practices that can be invented only within the Tropics.

This problem of the bush fallow is only one among a great many. With tropical soils we have an enormous problem of phosphorus deficiency and fixation. Many tropical soils are underlain with laterite that hardens to a resistant rock upon exposure. Important unknown processes maintain the nitrogen supply in many tropical soils. If we knew the principles involved we would have a great advantage. And, of course, there are special problems of crop protection against diseases and insects. Only a little has been done to improve efficiency through plant breeding.

On this general point of the need for research I want to quote from Sir E. John Russell, who has stated the matter clearly in his new and useful book on *World Population and Food Supplies* (513 pp., Allen and Unwin, London, 1954):

"The problem in Africa," he writes, "is to convert the peasant agriculture into a better system capable of giving increasing output as the need increases. Difficult technical and scientific problems are involved which are not yet solved, and which require for their solution highly skilled investigators left to work in peace and security. They cannot be adequately dealt with by visiting experts remaining for a few months only,

but with no permanent interest in the country; nor could they be solved by people who have merely learned something at a college and got a degree. Scientific acumen of a high order is needed; it cannot be imparted but only developed in those in whom it is inborn. Such men can only be attracted, not produced."

The longer such research is delayed, the longer it will take to get tropical agriculture going on an efficient basis.

Industrial development needs to go along with agricultural development, especially in crowded countries where farms can be efficient only if they are larger and tenure is more stable. In such countries both food crops and those industrial crops that local industries can use need emphasis.

We must continue to recall that an efficient agriculture requires power, chemicals, machinery, transport, and medical facilities. Agriculture must be enormously efficient to support such services by itself. With a few exceptions, such as Hawaii and Queensland, efficient agriculture in the world shares the costs for social services with mining or other pursuits, and especially with industry. Our Middle West is an excellent example. Here farmers have access to abundant facilities the costs of which are widely shared with other producers.

Farm products for export will be needed in many countries to balance the economy; but only rarely can export crops balance it alone when all the chemicals, machinery, and other requirements must be imported; and even then only when the country has a customs union with an industrial country.

In some underdeveloped countries two related difficulties stand in the way of emphasizing both food crops and industrial crops for export: (1) a native suspicion of "estates" carried over from older less gentle colonial days, and (2) the uncertainty of world markets. The first of these can be illustrated by the Gold Coast, where at least a few estates would be invaluable for the necessary large-scale experimentation with the present main crop, cocoa, and potential new crops, such as paddy rice, cotton, and sugarcane.

The second problem can be illustrated with rubber. Malaya is worried about the rubber market now and attempts are being made to try cacao and other crops. Few countries want to increase rubber because nobody seems to know the future of synthetic rubber. In fact, natural rubber may be in short supply within a few years. Similar uncertainties can be raised about sisal, abaca, and oil palm. For years sugarbeets in the temperate region have competed strongly with the sugarcane of the Tropics.

Perhaps I have taken too much of my time for the humid Tropics. Other examples could have been chosen from the dry Tropics, from the Arctic,

or from the great deserts—examples of soil management problems having a special and different significance than they have in the advanced countries of temperate regions.

In summary, the estimates of the available soils for agricultural use and of the production possible from those soils are considerably higher than the prospective population of this century. Difficult as are the technical problems, especially in the Tropics, the institutional and economic problems standing in the way of farmers realizing this potential abundance are even more difficult.

World agricultural production has increased some 25 percent in the last 10 years. This is significant. But taking the world as a whole, the total calories per capita decreased in relation to the years just before World War II, and the quality of many diets decreased. Yet last year, for the first time since the War, there was a world-wide increase in food production per capita. This fact can be misleading, since total supplies were unevenly distributed. Improvements in advanced countries were offset by reductions in some of the underdeveloped areas with large population increases. If all announced plans for both agricultural and industrial developments are carried out, and reasonably good trade continues, the situation will improve. Thus it can be said that a cautious immediate optimistic view is possible. Yet we must remind ourselves that these trends could stop or even be reversed. Any let up in the planned efforts, widespread poor weather for crops, or reduced international movement of capital, of production materials, or of food, would prevent significant improvement in food supplies in those countries having expanding populations and low current food production.

# THE RESOURCES AND PERFORMANCE OF SOVIET AGRICULTURE

Chairman: Merrill K. Bennett, Stanford University

## SOVIET AGRICULTURAL RESOURCES REAPPRAISED

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**S**OVIET attempts to increase total agricultural production have followed three main lines: (1) the expansion of the total cultivated acreage; (2) the increase of crop yields on existing cropland; and (3) a shifting to more intensive, higher yielding crops, such as corn.

The absolute physical limits of agricultural output probably are never achieved under actual producing conditions and are rarely even approached. In the Soviet Union, as in all other countries, room exists for a considerable increase in farm output through new or improved technology, better management, larger investments in machinery, fertilizer, and buildings, and more favorable economic conditions. I shall not be dealing with such possibilities in this paper. Rather shall I confine myself to a consideration of the natural conditions that underlie agriculture in the Soviet Union.

Since climate clearly is the most significant natural feature affecting agriculture in the Soviet Union, I shall limit myself in this paper to the effect of climate on the three main lines of potential agricultural development, specifically, (1) climatic aspects of the possibilities for expanding the cultivated area; (2) American climatic analogues of the Soviet Fertile Triangle as clues to the possibilities of increasing yields per acre; and (3) climatic aspects of corn production in the Soviet Union.

### 1. *Climatic Aspects of the Possibilities for Expanding the Cultivated Areas*

In both the Soviet Union and North America an agricultural heartland borders vast wastelands climatically unsuited to cultivation (Fig. 1). These heartlands are bordered on the north by tremendous expanses too cool for regular farming and on the interior by immense arid or semiarid plains too dry for nonirrigated crops. In North America this heartland extends from the Atlantic Seaboard westward to the Great Plains and reaches from the Gulf of Mexico northward into the southern fringe of Canada. A corresponding agricultural heartland in the Soviet Union, called the Fertile Triangle, stretches from corners at Leningrad on the Baltic Sea and Odessa on the Black Sea eastward to somewhat beyond the Ural Mountains (Fig. 2).

## COLD AND DRY CLIMATES OF THE EARTH

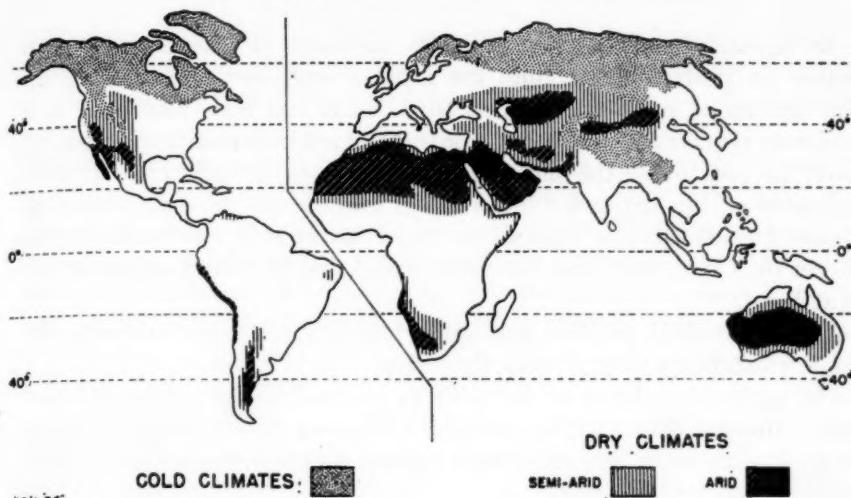


FIG. 1. COLD AND DRY CLIMATES OF THE EARTH. (After Köppen and Trewartha.)

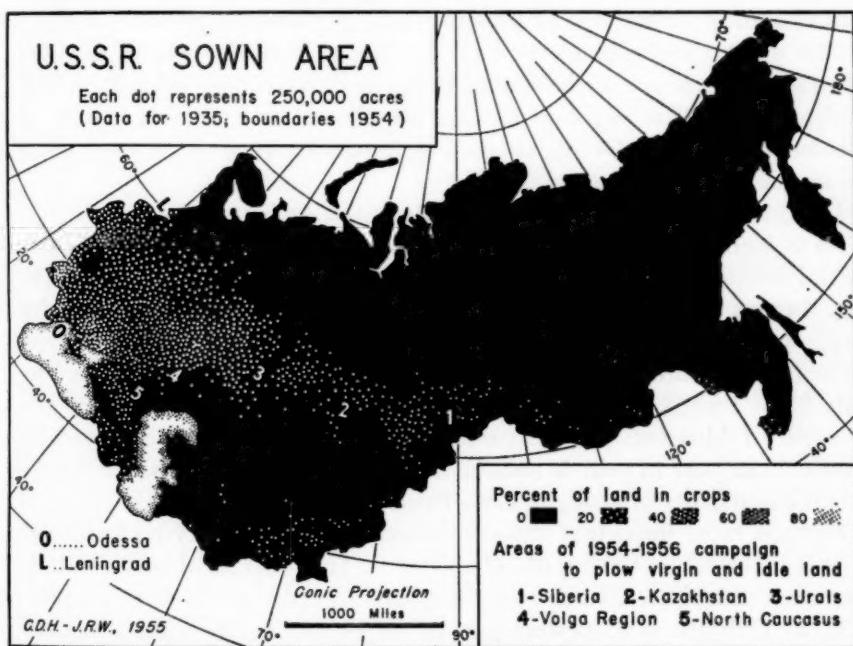


FIG. 2. SOWN AREA IN THE U.S.S.R. (After *Bol'shoi Sovetskii Atlas Mira*, Tom I (Moscow, 1937), Plate 155-156 and U. S. Office of Foreign Agricultural Relations, *Agricultural Geography of Europe and the Near East*, U. S. Department of Agriculture, Miscellaneous Publication No. 655. (Washington: Government Printing Office, 1948), p. 28.)

An age-old question is whether the frontiers of present cultivation cannot be pushed farther into the gigantic unfarmed spaces (Fig. 2). The amount of cultivated land in the U.S.S.R. has been increasing at a moderate rate for many decades. Some tracts not now cultivated certainly could be put under the plow, particularly patches within the present farmed area. But expansion of plowland into the empty areas shown on Figure 2 faces climatic difficulties. Some Soviet land now cultivated is poorer than farm land that has been abandoned in New England or the Dust Bowl.

High latitudinal position and great longitudinal extent underlie the climatic handicaps to expanding the Soviet cultivated area.

The agricultural heart of the U.S.S.R. lies well to the north of that of North America (Fig. 1). The northern coniferous forests and the treeless Arctic tundra cover five and a half million square miles, or nearly two-thirds, of the Soviet Union.

Expansion of the cultivated land toward the north is not prevented by any single factor but is discouraged by a combination of many climatically related features: a cool, short, irregular growing season; infertile podzol soils; poor drainage; and permafrost (permanently frozen subsoil).<sup>1</sup>

The great longitudinal extent of the Soviet Union results in extreme continentality. Much of the Soviet Union is thousands of miles from any body of water that might ameliorate the climate or provide a source of moisture. The Arctic Ocean, covered by ice during most of the year, plays no significant mitigating role.

Continentality affects both temperature and moisture.

As is well known, temperature extremes characterize the deep continental interior, particularly Siberia. Cold winters hinder the overwintering of crops or fruit trees. Spring grains rather than winter grains are the staple crop. It is not so well known that the average frost-free season decreases eastward from 160 days at Leningrad to 130 at Moscow and to only 95 at Irkutsk, although Moscow is south of Leningrad and Irkutsk is south of Moscow. A high variability in the length of the frost-free season from year to year is associated with the dangerous risk of unseasonable late frosts in spring or early frosts in fall.

Perhaps more important than the effect of continentality on temperature is its effect on the supply of moisture. The amount of precipitation decreases sharply eastward from the western border of the Soviet Union (Fig. 3). Only the northwestern part of the Fertile Triangle has adequate moisture. Long before the moisture-laden winds from the western seas penetrate deeply into the interior, they have dropped their main charge of precipitation.

<sup>1</sup> Chauncy D. Harris, "U.S.S.R. Resources: II—Agriculture," *Focus* (American Geographical Society), vol. 5, no. 9 (May 1955), pp. 1-6.

The expansion of the cultivated area toward the dry interior is difficult. The southeastern agricultural frontier is risky because of the low total rainfall, the high variability from year to year, and the occasional occurrence of desiccating winds called *sukhovey*.

A hazardous campaign is currently under way to cultivate 70 million new acres of semiarid land in Western Siberia, Kazakhstan, the Urals, the Volga region, and the North Caucasus during the three years 1954-1956 (Fig. 2).<sup>2</sup> These areas have approximately the climatic conditions of Montana and eastern Wyoming, that is a rainfall of less than 15 inches but mean July temperatures of about 70 degrees Fahrenheit.

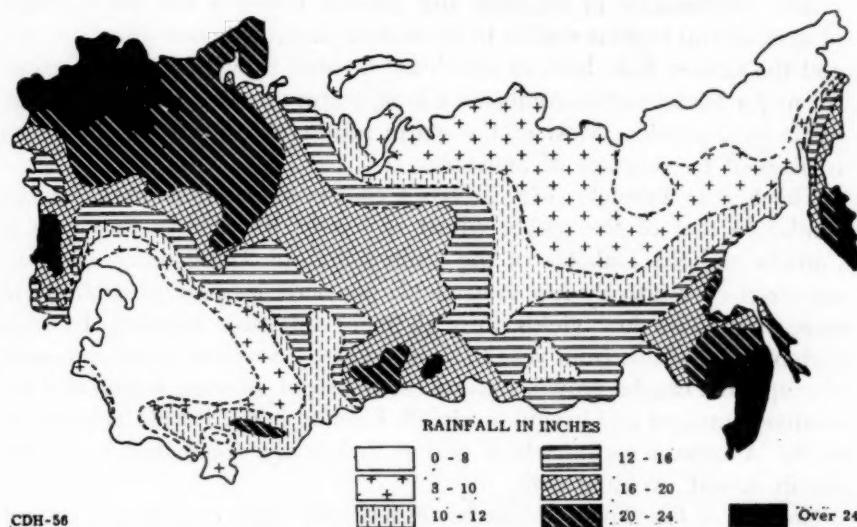


FIG. 3. RAINFALL, U.S.S.R. (After *Bol'shoy Sovetskiy Atlas Mira*, Tom I, Plate 112.)

In such areas soils structure is important. It is reported that in the past good yields have been obtained in the first year on many soils. But a breakdown of soil structure and rapidly declining yields have resulted in abandonment of cultivation after a few years. After two or three decades of noncultivation, the natural vegetation has sufficiently restored the soil organic matter, moisture holding capacity, and structure to permit another short cycle of cultivation.<sup>3</sup> Whether new methods of plowing and soil and moisture conservation have solved this problem remain to be demonstrated.

<sup>2</sup> W. A. Douglas Jackson, "The Virgin and Idle Lands of Western Siberia and Northern Kazakhstan: A Geographical Appraisal," *Geographical Review*, vol. 46, no. 1 (January 1956), pp. 1-19.

<sup>3</sup> P. I. Kralin and others in *V Pomoshch' Spetsialistam Sel'skogo Khozyaistva po Osvoeniyu Tselinykh i Zaleznykh Zemel'*, Sbornik Materialov i Statei, Tom 1 (Moscow, 1954), *passim*.

It is my prediction that the program for plowing of idle and virgin lands will fall far short of the announced production goals, although it will result in some additions to the cultivated acreage.

## 2. American Climatic Analogues of the Soviet Fertile Triangle as Clues to the Possibilities of Increasing Yields Per Acre

Because of unfavorable climatic conditions, the ultimate physical limits of agricultural output per acre, even in the agricultural heartland of the Soviet Union, are low, much lower than in the Eastern United States or Western Europe.

The combination of coolness and dryness deprives the Soviet Union of agricultural regions similar to the richest American ones—the Corn Belt and the Cotton Belt, both of which are favored by warm moist climates. No major Soviet region combines a long, warm growing season with adequate precipitation. Most of the warm southernmost part of the Union is plagued by shortage of moisture.

The Fertile Triangle (Fig. 2), has a cool continental semiarid climate similar to that of the spring wheat region of the Prairie Provinces of Canada and the Dakotas of the United States.<sup>4</sup> These areas are characterized by relatively low crop yields per acre, by poor possibilities of increasing these low yields through more intensive farming, by high variability of yields from year to year, and by a severely restricted range of crops that can be grown. Because of the short growing season and the relatively meager and irregular rainfall, farming in the Fertile Triangle, as in the American spring wheat region, is heavily dominated by grains, mainly wheat, rye, and oats.

No part of the Soviet Union has exactly the same climate as any part of North America.<sup>5</sup> But if one considers only certain key aspects of climate, one can establish points in the two areas that have roughly analogous climates. The two chief climatic variables that should be taken into consideration are precipitation and temperature. For purposes of simple comparison we shall take mean annual precipitation and mean

<sup>4</sup> M. Y. Nuttonson, *Ecological Crop Geography of the Ukraine and the Ukrainian Agro-Climatic Analogues in North America*, "International Agro-Climatological Series Study No. 1," (Washington, D.C.; American Institute of Crop Ecology, 1947).

M. Y. Nuttonson, *Agricultural Climatology of Siberia, Natural Belts, and Agro-Climatic Analogues in North America*, "International Agro-Climatological Series Study No. 13" (Washington, D.C.; American Institute of Crop Ecology, 1950).

M. Y. Nuttonson, "Agroclimatology and Crop Ecology of the Ukraine and Climatic Analogues in North America," *Geographical Review*, vol. 37, no. 2 (April 1947), pp. 216-232.

<sup>5</sup> On the climate of the Soviet Union see A. A. Borisov: *Klimaty SSSR* (Moscow; Uchpedgiz, 1948), and W. Köppen: *Klimakunde von Russland in Europa und Asien, "Handbuch der Klimatologie, 2. Hälfte, Teil N2: Tabellen"* (Berlin; Gebrüder Borntraeger, 1939).

July temperature. Figure 4 indicates the location in relation to the Soviet Fertile Triangle of specific climatic stations to be compared with North American stations. These are Odessa, Rostov, Stavropol', Saratov, Chkalov, Akmolinsk, and Barnaul along the southern and southeastern dry margin of the Fertile Triangle; Novosibirsk, Tobol'sk, Cherdyn', and Leningrad along the cool northern edge of the Fertile Triangle; Riga and L'vov along the western border of the Fertile Triangle in territories acquired from



FIG. 4. LOCATION OF SELECTED CLIMATIC STATIONS IN RELATION TO THE FERTILE TRIANGLE—U.S.S.R. (O—Odessa, R—Rostov, St—Stavropol', S—Saratov, Ch—Chkalov, A—Akmolinsk, B—Barnaul, N—Novosibirsk, T—Tobol'sk, C—Cherdyn', L—Leningrad, Ri—Riga, Lv—L'vov, K—Kiev, Kh—Kharkov, and M—Moscow.)

Latvia and Poland during World War II, and Kiev, Khar'kov, and Moscow, in the heart of the Soviet agricultural belt.

Figure 5 shows the network of isotherms for average July temperatures and isohyets for mean annual precipitation in North America. The Soviet stations, indicated in Figure 4, are placed in this network at the appropriate rainfall and temperature intersections. The point in North America with approximately the same July temperature and mean annual precipitation as Odessa lies in southwest South Dakota. The analogue for Rostov falls in central South Dakota. Stavropol', in the more moist North Caucasus, corresponds to west central Minnesota. Saratov lies in North Dakota and Chkalov in southeast Montana. Akmolinsk, which is drier, lies in south central Montana where the arid region of the southwestern United States makes its greatest extension to the northeast to

touch the edge of the Great Plains. Barnaul corresponds to southwestern Saskatchewan in the driest part of the Canadian prairies. Novosibirsk falls north of Regina in Saskatchewan, and Tobol'sk to the northeast. Cherdyn', with somewhat more rainfall, Leningrad, the northwest anchor of the Fertile Triangle, and Riga lie northwest of Lake Superior. L'vov, exemplifying the relatively moist and mild western borderlands of the Soviet

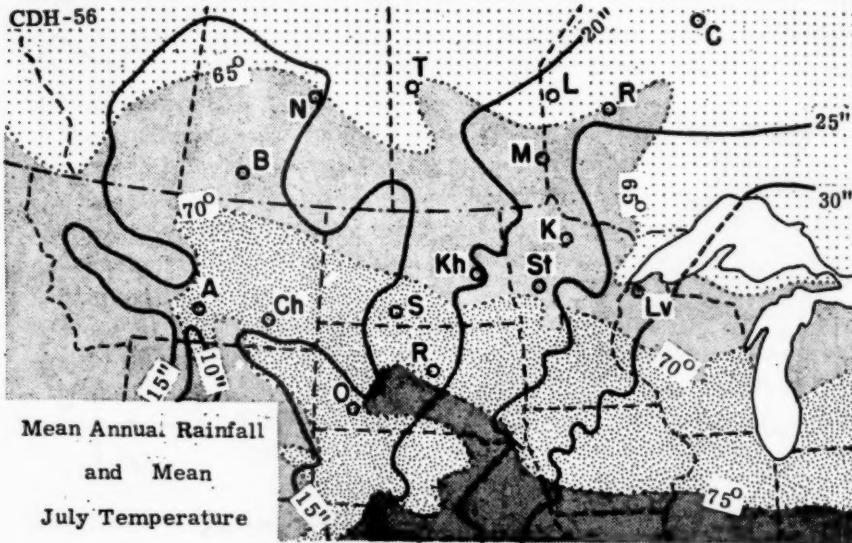


FIG. 5. NORTH AMERICA. LOCATION OF ANALOGUES OF SOVIET CLIMATIC STATIONS OF FERTILE TRIANGLE. Soviet climatic stations are placed at points in North America having the same mean annual rainfall and mean July temperatures. (O—Odessa, R—Rostov, St—Stavropol', S—Saratov, Ch—Chkalov, A—Akmolinsk, B—Barnaul, N—Novosibirsk, T—Tobol'sk, C—Cherdyn', L—Leningrad, Ri—Riga, Lv—L'vov, K—Kiev, Kh—Khar'kov, and M—Moscow.)

Isotherms and Isohyets from U. S. Department of Agriculture, *Climate and Man, Yearbook of Agriculture 1941* (Washington, D.C.: Government Printing Office, 1941), pp. 705 and 711 and Morley K. Thomas, *Climatological Atlas of Canada*, A Joint Publication of the Division of Building Research, National Research Council, and the Meteorological Division, Department of Transport, Canada (Ottawa, National Research Council of Canada, 1953), charts 1-5 and 5-1, pp. 23 and 129.

Union is near Duluth. Kiev, Khar'kov, and Moscow, in the heart of the best Soviet agricultural land, lie respectively in extreme northern Minnesota, eastern North Dakota, and southeastern Manitoba.

The western part of the Fertile Triangle is less continental than interior North America; it has slightly milder winter conditions and a longer growing season than American areas with similar summer temperatures. Using the network of annual rainfall and of mean January temperature (instead of July), Odessa would fall into eastern Colorado instead of South

Dakota. Odessa lies in an area suited to winter wheat production but with dry conditions for high yields. On the other hand, points in the eastern part of the Fertile Triangle would be displaced northward if winter temperatures were used, since east of the Volga the annual range of temperature is greater than in corresponding parts of North America.

Yield figures for Soviet crops, comparable with those in other parts of the world, have not been published for many years. The average yields of North Dakota may give some clues to Soviet yields. The 10-year averages for North Dakota for the years 1946-1955 follow (with average yields for the entire United States for the same years in parentheses); wheat 12.4 bushels per acre (17.4), barley 20.9 (26.6), oats 26.3 (34.1), rye 13.2 (12.5), corn 20.8 (37.5), and hay 0.94 tons per acre (1.40).

The trend appears to be for the North Dakota yields to fall farther and farther behind national averages (Figure 6 and 13). In successive 10-year averages by decades (1891-1900, 1901-1910, etc.), North Dakota wheat yields were 5, 15, 25, 20, 39, and 10 per cent below national averages. The decade 1931-40 with drought had excessively low yields. The decade 1941-50 with unusually good weather had the highest relative yields in half a century; after it another sharp decline set in. Stated another way, in North Dakota the 10-year average wheat yield 1946-55 was about the same as the average for 1891-1900, whereas for the United States as a whole the average yield in the latter period was 31 per cent higher than in the earlier one (Fig. 6).

Long-range trends are difficult to appraise because of the violent fluctuations from year to year in yields (Fig. 6). In 1895 the yield of wheat in North Dakota was 21.0 bushels per acre but in 1900 only 4.9; in 1936 it was 5.2 but in 1942, 20.5.

D. Gale Johnson has pointed out that the potentialities for increasing yields are much better in areas of high precipitation than in areas of low precipitation. In moist areas in the United States experiment stations usually have higher yields than county-wide averages and thus indicate opportunity for a considerable increase in average yields. In dry areas, however, experiment stations seem to attain only about average yields. One may infer from these data that in dry areas the possibilities of raising yields by more careful methods, such as those used on experiment stations, are relatively poor. Johnson also cites many experiments with fertilization in the United States which tend to show that in dry areas in dry years fertilization has no significant effect, whereas in more moist areas fertilization substantially increases yields.<sup>6</sup>

<sup>6</sup> D. Gale Johnson, *A Study of the Growth Potential of Agriculture of the USSR*, Rand Research Memorandum No. 1561 (Santa Monica, Calif. Rand Corporation, 1955), pp. 42-44 and 63-71.

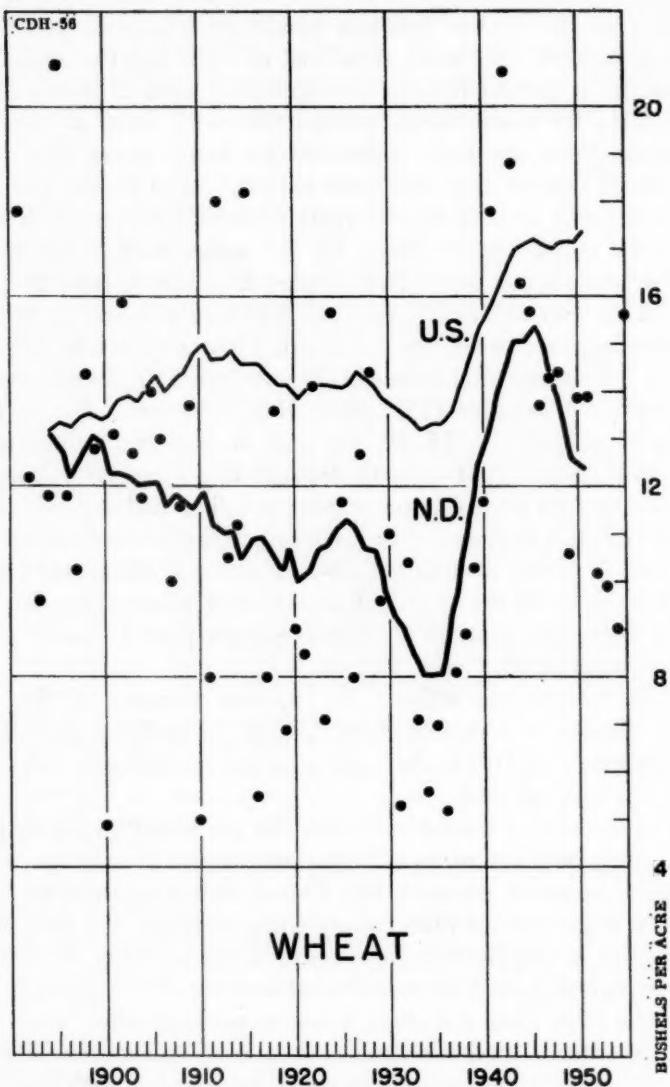


FIG. 6. WHEAT YIELDS EACH YEAR 1891-1955 FOR NORTH DAKOTA, WITH 10-YEAR RUNNING AVERAGES CENTERED ON THE MID-POINTS FOR NORTH DAKOTA AND THE UNITED STATES. (Data from *Agricultural Yearbooks*, *Agricultural Statistics*, and *Crop Production, Annual Summaries*.)

Since a large part of the agricultural land of the Soviet Union has semiarid conditions, one may infer that increases in yield will be difficult to achieve. This generalization applies to the whole southern band of the Fertile Triangle. On the other hand on the nonchernozem lands of Central Russia, near Moscow, where precipitation is higher and the soils poorer, fertilization has potentialities.

After considering briefly some of the physical problems of expansion of the cultivated acreage and of increasing yields on the present agricultural area, we now turn to the most recent Soviet proposal, that of increasing production significantly by a shift of millions of acres from pasture, meadow, or small grains into corn.

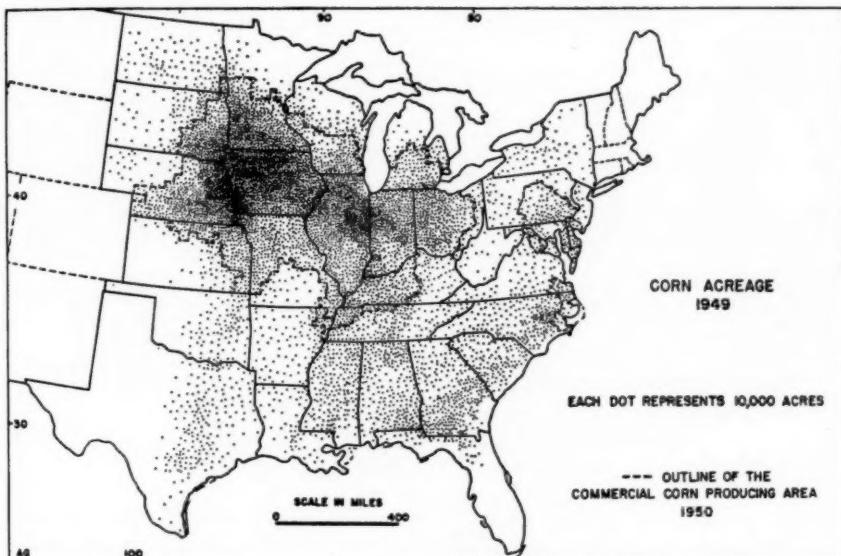


FIG. 7. CORN ACREAGE IN THE UNITED STATES 1949. (From Andreas Grotewold, *Regional Changes in Corn Production in the United States from 1909 to 1949*, University of Chicago, Department of Geography, Research Paper No. 40 (Chicago: University of Chicago, Department of Geography, 1955, p. 10. Data not shown for New England and Western States.)

### 3. Climatic Aspects of Corn Production in the Soviet Union

Detailed recent Soviet statistics on distribution of area planted in corn or of yields per acre are not available. We shall, therefore, make certain inferences about Soviet possibilities based on experience in the United States.

Corn is widespread in the eastern half of the United States but the main concentration of production is in the Corn Belt stretching from eastern Nebraska to Ohio (Fig. 7).

Two climatic conditions limit the extension of corn production in the United States: temperature and rainfall. "Corn is unique among the cereals in the enormous differences that exist among strains developed to meet the needs of diverse conditions of temperature, moisture, length of growing season, and other environmental factors."<sup>1</sup> Nevertheless, for the high-yielding corn of the type commercially cultivated in the United States, the climatic limits are fairly sharp. In spite of intense efforts in the

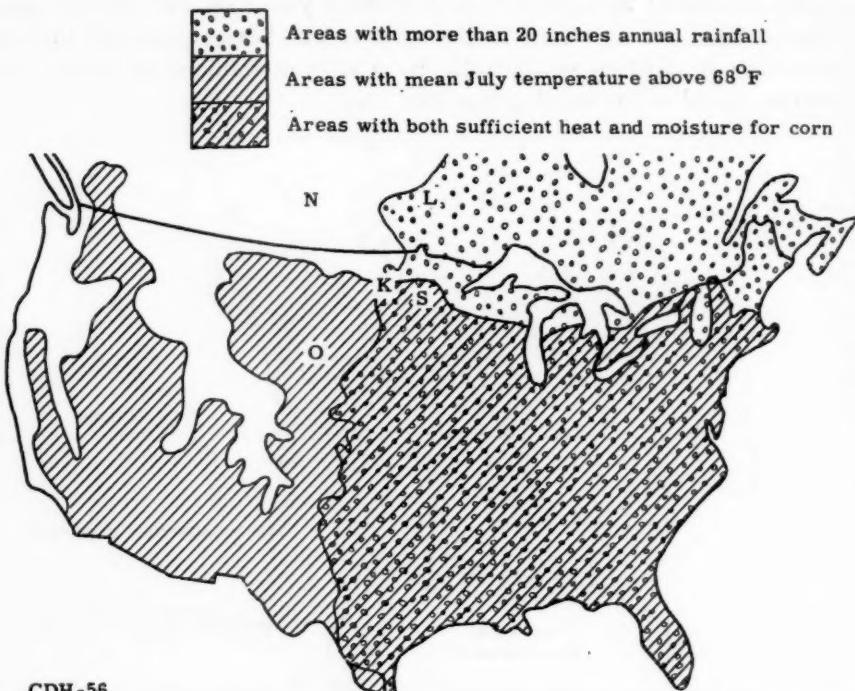
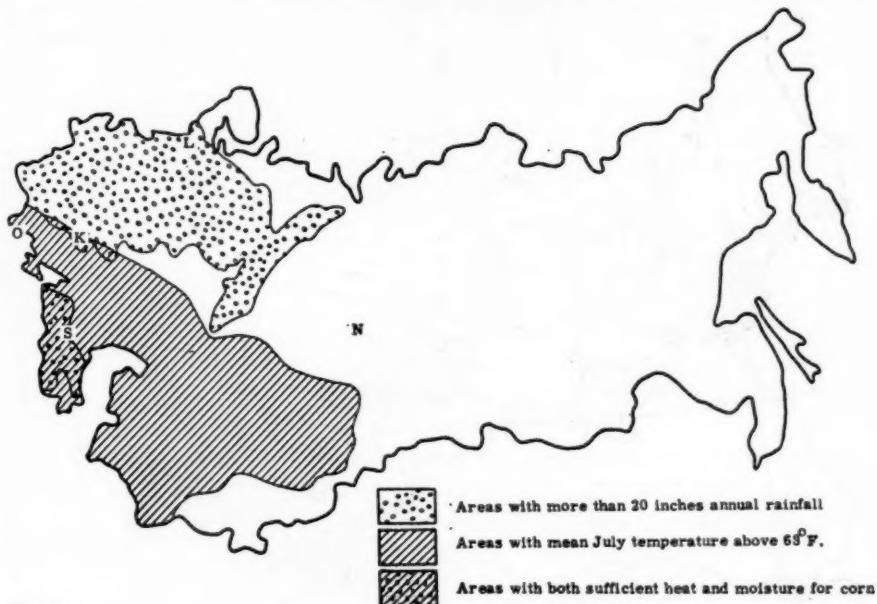


FIG. 8. AREA IN THE UNITED STATES CLIMATICALLY SUITED TO CORN. Corn requires both hot and moist summers. (Location of Soviet Climatic Analogues: O—Odessa, L—Leningrad, N—Novosibirsk, S—Stavropol', and K—Khar'kov.)

United States to develop strains of corn that will mature in cooler or drier regions, little commercial corn is grown in this country in areas having a mean July temperature below 68° Fahrenheit (20° Centigrade), or a mean annual rainfall of less than 20 inches. Actually the necessary amount of precipitation on the dry margin of corn production varies with summer temperature and evaporation. In North Dakota some corn for silage, for forage, or for grazing is grown in cool districts having as little as 15 inches of rainfall.

<sup>1</sup> Merle T. Jenkins, "Influence of Climate and Weather on Growth of Corn," *Yearbook of Agriculture, 1941, Climate and Man* (Washington, D. C.: Government Printing Office, 1941), p. 309.

The area in the United States climatically suited to corn production, i.e., the area with a mean July temperature higher than 68° F. and with an annual rainfall of more than 20 inches, includes most of the eastern half of the United States and excludes only a very narrow strip along the northern edge of the country and the western deserts and semiarid stretches (Fig. 8). The commercial corn producing area occupies only a fraction of the total area climatically suited to corn, in general areas



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FIG. 9. AREA IN THE SOVIET UNION CLIMATICALLY SUITED TO CORN BY UNITED STATES STANDARDS. (O—Odessa, L—Leningrad, N—Novosibirsk, S—Stavropol', and K—Khar'kov.)

with a July mean temperature above 70° and with more than 25 inches of rainfall.

Figure 9 shows the area climatically suited to corn production in the Soviet Union based on American experience. Whereas in the United States the rainfall and temperature lines lie at right angles to each other, so that one goes north to cooler lands and west to drier lands, in the agricultural heartland of the Soviet Union the two lines run parallel to each other but increase in opposite directions with the result that warm areas are dry and moist areas are cool. The part of the Soviet Union with a mean July temperature above 68° Fahrenheit includes a band in the southern Ukraine, the North Caucasus or Kuban, and most of Soviet Central Asia. But with small exceptions, mainly in the North Caucasus, this area has less than 20 inches of annual rainfall and is therefore too dry for corn. On the other hand the area with more than 20 inches of

annual rainfall forms a triangle with the base on the western border of the Soviet Union and the apex in the middle Urals (Fig. 3). All of this triangle, except for a very narrow fringe near Khar'kov, has mean July temperatures below 68°. Thus with the exception of small areas in the Caucasus and in the North Caucasus, and near Khar'kov, no part of the Soviet Union has both favorable temperature and moisture conditions for corn.

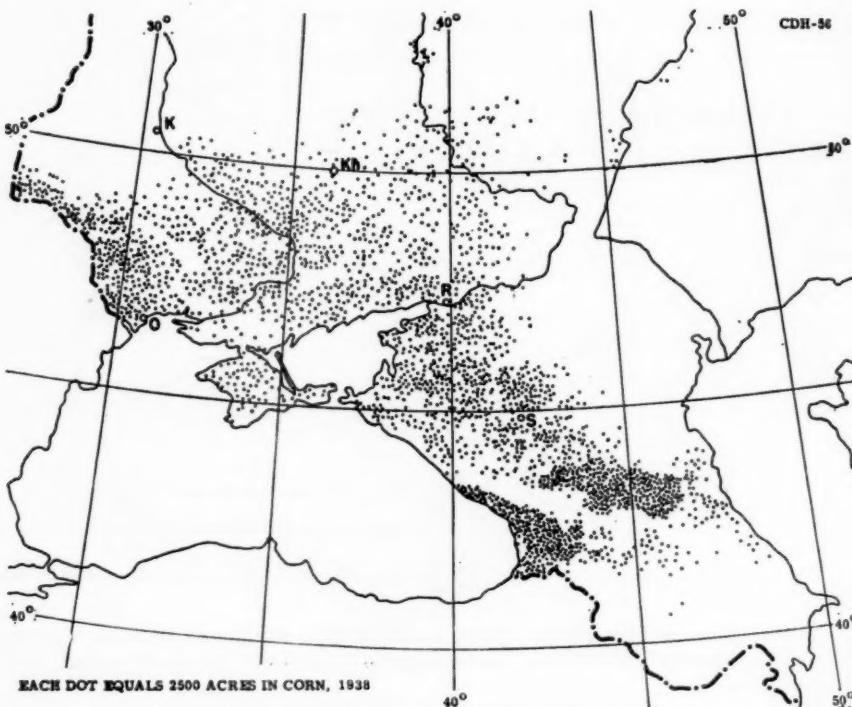


FIG. 10. CORN ACREAGE IN THE SOVIET UNION, circa 1938. (After S. S. Balzak, V. F. Vasyutin, and Ya. G. Feigin, *Economic Geography of the USSR* (New York: Macmillan, 1949, Fig. 59, p. 389. O—Odessa, K—Kiev, Kh—Khar'kov, R—Rostov, and S—Stavropol.)

The problem also poses tremendous opportunity. If Soviet plant breeders can develop a corn with a shorter growing season or lesser moisture requirements and thus close the gap between the thermal and moisture barriers, large areas may be opened to corn production.

In the absence of conditions for good grain-corn production, the Soviet leaders are stressing the growth of corn for fodder and silage.

The traditional areas of major concentration of corn production lie in the North Caucasus, in Georgia in the Trans-Caucasus, and in Besarabia on the southwestern boundary of the Soviet Union (Fig. 10).

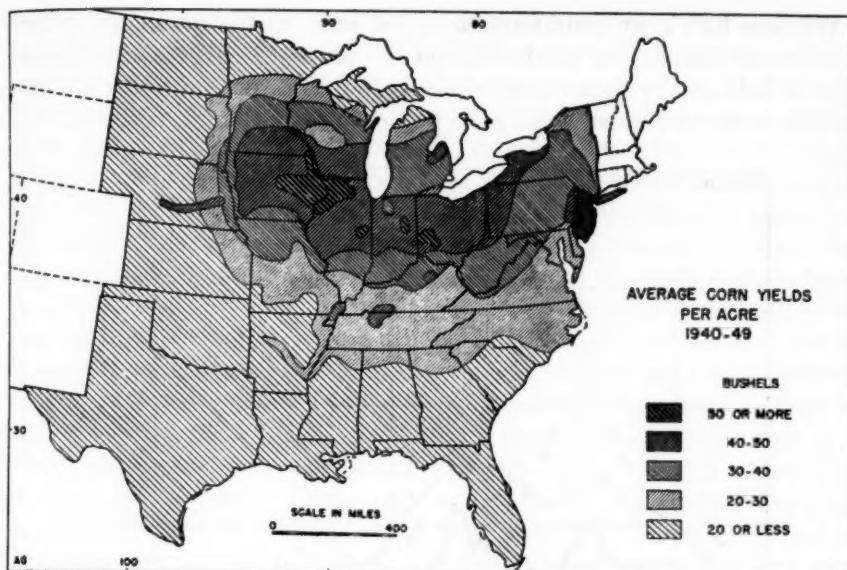


FIG. 11. CORN YIELDS PER ACRE IN THE UNITED STATES, AVERAGE 1940-1949.  
(From Grotewold, *op. cit.*, Fig. 6, p. 14.)

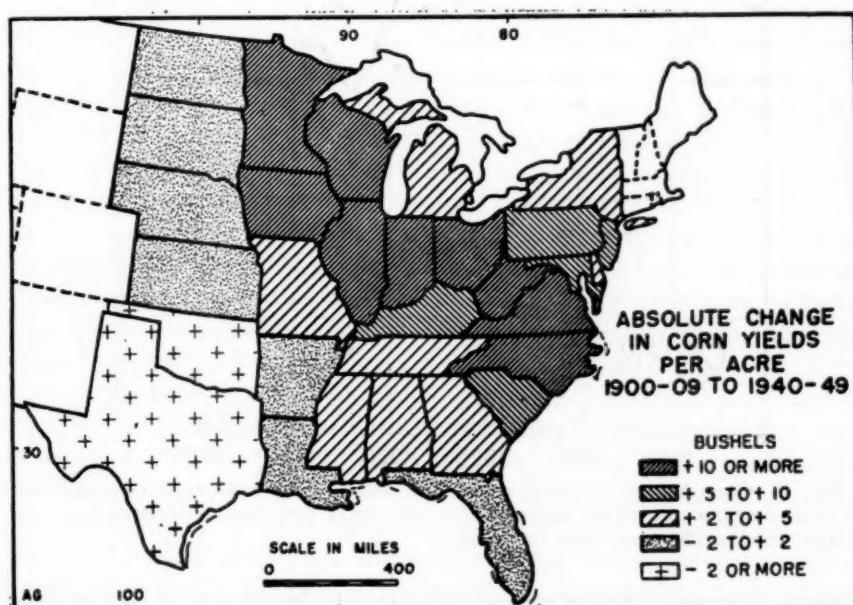


FIG. 12. CHANGES IN CORN YIELDS PER ACRE FROM AVERAGE OF 1900-1909 TO AVERAGE  
OF 1940-1949. (After Grotewold, *op. cit.*, Fig. 9, p. 23.)

We now turn from consideration of the areas suitable for corn to the question of intensity of production on the areas devoted to corn. Great hope is held out by Soviet leaders for a big increase in corn yields, comparable to the American upsurge in productivity in the last 15 years.

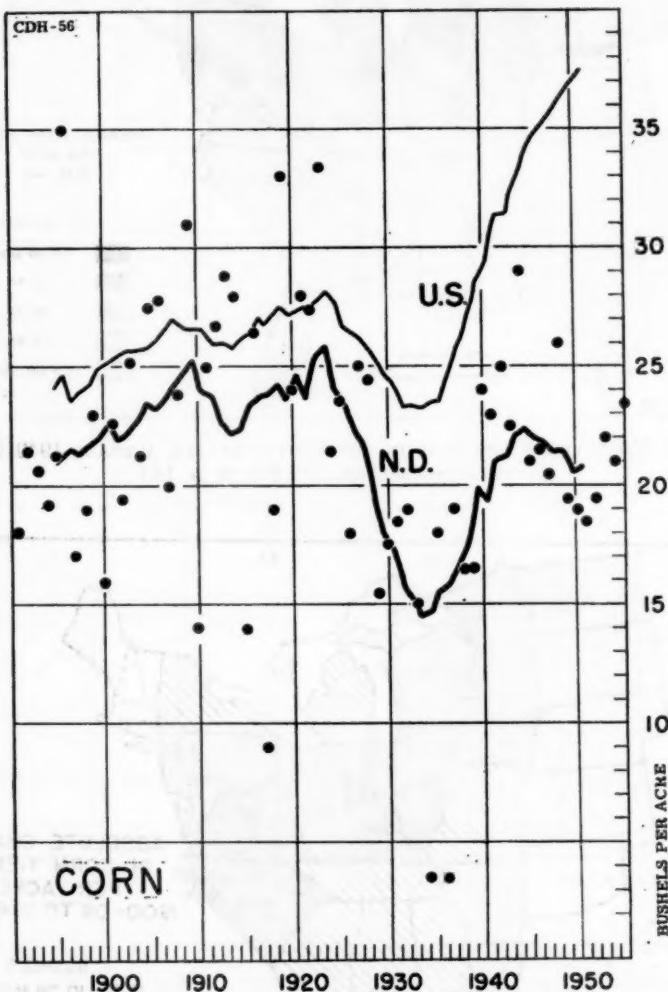


FIG. 13. CORN YIELDS PER ACRE EACH YEAR 1891-1955 FOR NORTH DAKOTA, WITH 10-YEAR RUNNING AVERAGES CENTERED ON MIDPOINTS FOR NORTH DAKOTA AND THE UNITED STATES. (Sources: same as Figure 6.)

Some estimate of Soviet potentialities in this direction may be made on the basis of American experience. Figure 11 depicts corn yields per acre in the United States and indicates that states with climatic conditions similar to those of the Soviet Union have low yields. One may well ask

whether yields cannot be improved. Figure 12 shows the absolute change in corn yields per acre in the United States since the beginning of the century. The states along the dry margin of corn production, with conditions similar to those in Soviet corn producing areas, have achieved little or no increase in yield in the last half century. The states with the large gains in yields per acre are those with more abundant moisture. Again the case of North Dakota is instructive (Fig. 13). Although corn yields for the United States as a whole have shown a general rise (except for the depression and drought years of the 1930s), yields for North Dakota have dropped since the early 1920s. In successive decades since 1901-1910 North Dakota yields have averaged 11, 11, 12, 34, and 36 per cent below national averages and by 1946-1955 had declined to 45 per cent below the national average. Average corn yields in North Dakota for the decade 1946-55 were slightly below 1891-1900, whereas in the United States as a whole yields were more than 50 per cent higher (Fig. 13). It would appear that the introduction of hybrid corn and substantial fertilization has paid rich dividends in the middle and eastern parts of the Corn Belt but has had little effect in North Dakota. Furthermore, although most corn production in the United States is for grain, in North Dakota only about a third is for grain, another third for silage, and about a third for grazing and forage.

The introduction of hybrids has produced meager results in dry areas, but has played a valuable role in a northward movement of successful grain-corn production into cooler areas, as in Minnesota. Here lies perhaps the major Soviet opportunity in corn. If hybrids can be developed in the Soviet Union that will move the cool limit of corn production northward, new areas with more favorable moisture conditions may be opened to corn.

Silage corn can be grown in cooler and drier areas than grain corn, but the shorter or drier the growing season and the less mature the corn at the time it is cut for silage, the lower the yield. In 1954 the average yield per acre of corn for silage was 3.8 tons in North Dakota compared with 8.6 in Minnesota, 9.5 in Wisconsin, and 10.0 in Iowa.

Thus attempts to increase Soviet agricultural production are confronted with unfavorable climatic conditions. Expansion of the cultivated area either to the cool north or to the dry southeast faces hazardous irregularities and insecurities. The potentialities for increasing yields per acre appear to be somewhat more limited than in American or European areas with more adequate precipitation or longer growing seasons. Finally climatic conditions in most agricultural areas of the Soviet Union are unfavorable for high yields of grain corn. The extreme physical limits probably have not been reached in any of these directions, but costs of further development are likely to be relatively high per unit of output.

## SOVIET AGRICULTURAL POLICY AFTER STALIN: RESULTS AND PROSPECTS

LAZAR VOLIN

Foreign Agricultural Service  
United States Department of Agriculture

WITH the end of the Stalin era, the agricultural problem has again come to the very foreground of the Russian politico-economic scene. This has occurred at every critical juncture in Russian history. The recent emergence of the agricultural problem, however, may seem surprising inasmuch as Russia has been undergoing intensive industrialization for more than half a century and has lost much of its formerly predominant agrarian character; although it is still one of the leading agricultural countries of the world with 485 million acres under crops in 1955. Yet, the very speed and, particularly, the lopsided nature of Soviet industrialization, investment and price policies, with overriding emphasis on heavy industry and neglect of light industry, manufacturing consumers' goods, has tended to aggravate the agricultural problem. Industrialization, Soviet style, has been largely responsible for squeezing the farmer with high exactions and inadequate returns and forcing him off the land. I have dealt with this fundamental issue elsewhere and shall not pursue it here.<sup>1</sup> This is worth recalling today and bearing in mind, when the Soviet Union is posing in Asia and Africa as the successful model of rapid industrialization by an underdeveloped country.

Nearly 20 years ago, in December, 1936, I was privileged to speak before this Association on a subject similar to today's.<sup>2</sup> Then Soviet Russia was in a process of recovery following Stalin's ruthless and gruesome collectivization drive, a drive that brought Russian agriculture to the brink of collapse. I pointed out that, "such recovery as has undoubtedly been taking place in Soviet agriculture . . . seems to be associated with the dilution of the rather rigorous policy of collectivization by injecting a dose of individualism with a view to winning the wholehearted cooperation of the Russian people." But I also cautioned that, "it would be ill-founded to exaggerate the extent of the concessions made to individualism in the realm of Soviet agriculture." In that connection I alluded to the inherent instability of the Soviet policy of concessions, since "the hand that grants may also withdraw." But despite all my skepticism I had not foreseen that a reversal of the somewhat more liberal policy of the mid-

<sup>1</sup> "Soviet Agricultural Collectivism in Peace and War," *American Economic Review*, Vol. XLI, No. 2, May 1951, pp. 465-474.

<sup>2</sup> "Soviet Agricultural Policy," *Journal of Farm Economics*, Vol. XIX, No. 1, 1937, pp. 280-286.

thirties would come so soon. In the late thirties, Stalin's agrarian policy hardened and veered in the direction of intensified collectivism. The small "acre and a cow" kitchen garden farming of collectivized peasantry, which was officially encouraged in the midthirties, was restricted. And, except for the interlude of the war, Stalin's policy did not change its direction until his death. Parenthetically, the fact that the end of the Second World War brought no change in agrarian policy, is contrary to the Russian experience when every other major war during the past century resulted in a more or less significant relaxation. But after the Second World War it became tougher.

The intensive collectivism of the Stalin era was combined with a naive faith in pseudo-science, promising spectacular, almost miraculous results in increasing agricultural production. The typical representative and the leader of this movement was the notorious Lysenko, who did his best to stifle Mendelian genetics and other branches of biological and agricultural sciences in the USSR. Some of this pseudo-science was at the root of much of what passed for the new "agrotechnique" and the famous Stalin plan of reconstruction of nature, about which so much was heard during the last years of the dictator's life.

The legacy that Stalin left, as a result of his policy, was a weak agriculture. Yet we cannot speak of a breakdown or a crisis; certainly not in the sense in which these terms could be applied to the collectivization period of the early 1930's, when famine stalked the land. Progress was even recorded in some branches of agriculture, such as cotton growing, for instance. In general, the weakness of agriculture was concealed, at least from the public, by the release from time to time of huge figures of so-called "biological" crops. They were estimated prior to the harvest and did not take into account the frequently officially admitted large harvesting losses. Such figures, as those for the total grain crop, issued without much supporting statistical detail, had to be taken with many grains of salt and required much downward adjustment. However, the need of such a large downward adjustment was sometimes questioned even in the West. It is therefore significant that one of the first important acts of Stalin's heirs on the agrarian front was the condemnation and jettisoning of the "biological" crop estimating procedure.

Whether the reappraisal of agricultural production figures proved agonizing or not, Stalin's successors certainly showed that they were deeply disturbed by the lagging agricultural production. While the United States has been beset with the problem of farm surpluses, Soviet Russia has been bedeviled by agricultural underproduction and scarcities.

Khrushchev's rueful comparison of a 10 percent increase in agricultural

output between 1940 and 1952,<sup>3</sup> with a more than doubled industrial production, drives the point home. The disparity between the postwar agricultural and industrial growth is too large, even if generous allowance is made for destruction wrought by the war. And the 10 percent increase still seems overoptimistic on the basis of barn crop production. The weakest link, however, as is well known, is animal husbandry. In contrast to the large increase of human population, most livestock numbers at the beginning of 1953 were below the precollectivization level and productivity of animals was low. Compared with the United States, the Soviet Union had at the beginning of 1953 less than half the cattle and hog numbers per 1,000 inhabitants, but exceeded the United States in the number of sheep and goats.<sup>4</sup> In that year the Soviet Union had somewhat less than half the number of hogs, and more than half of the number of cattle per 100 acres of the harvest area, than the United States. Average milk production per cow in collective herds was 2,200 to 2,360 pounds, or less than half of that in the United States. In some regions it was even lower. An old butter exporting region like Siberia was producing less butter in 1952 than in 1913. No wonder butter is imported rather than exported by the USSR. It is clear that without a significantly increased livestock production the monotonous starchy diet could not be improved and made more palatable and better balanced. But increased livestock production conflicted with high compulsory deliveries of livestock products and with the whole collectivization policy in animal husbandry. It presupposes an increased and better managed fodder supply. Hence the heavy accent on feed grains like corn and on hay.

It is true that increased agricultural production has always been a cardinal tenet of Soviet policy, under Lenin as under Stalin and his successors. But the late dictator could regard the low standard of living of the "underlying" population philosophically. He could, as I said elsewhere, adopt the Fabian tactics of gradualism in the matter of improving living and food production levels. His successors, being less firmly in the saddle, could not afford such a Fabian attitude. They had to assign higher priorities to these tasks. The urgency of the problem has been enhanced by the rapid growth of population. This is especially true of the urban population, which, according to Khrushchev, increased in five

<sup>3</sup> In a report to the Central Committee of the Communist Party of the USSR, *Pravda* and *Izvestiya*, September 15, 1953.

<sup>4</sup> There were, however, Soviet complaints of a faulty geographic distribution of sheep herds. Thus, Khrushchev criticized the fact that, by 1954, the number of cattle increased since the war only by 5 percent and the number of sheep by 55 percent in the so-called nonblack soil zone of the northern and north central European Russia, which include a number of important dairy regions. (*Pravda* and *Izvestiya*, March 21, 1954.)

years by 17 million.<sup>8</sup> From the Soviet standpoint, the urban folk, that is predominantly workers in state industries and the numerous bureaucracy, cannot be expected to "forage" for themselves as the peasants, the marginal members of Soviet society, are supposed to do. To be sure, large population, far from vexing the Kremlin, is welcome to it. For Khrushchev, a population growth of another 100 million is still small.<sup>9</sup> But even if the men in the Kremlin, good Marxists as they are, are not inhibited by the Malthusian spectre of "standing room only," they have nevertheless become increasingly concerned with the problem of feeding the growing millions. Another factor that added to the preoccupation of the post-Stalin administration with the agricultural problem was a serious drought for two successive years (1953 and 1954) in some of the normally most productive regions of the country, reducing heavily crop yields.

Thus, the objective of sharply increased agricultural production has become more pressing since Stalin's exit. Likewise, it could be argued, that with the high level of development already achieved by that favorite Soviet child, the heavy industry, greater priorities could be assigned to agriculture and the light industry. This, in essence, was apparently the thesis of Malenkov and his supporters until they were routed at the end of 1954.

Granting then the objective, what were the ways and means of carrying it out? They were long ago charted by Lenin and by the Stalin of prewar days. The central place in this blueprint was occupied by measures to stimulate the interest and cooperation of the peasants in production through increased economic incentives. It is only necessary to recall, in this connection, Lenin's celebrated NEP (New Economic Policy), and Stalin's relaxation of the iron grip in the mid-1930's. One can go further and say that Soviet policy in the agrarian, as in other, fields has always been a combination of coercion, indoctrination and economic incentives; but the proportions vary from time to time. The Russian peasant, under the Soviet regime, was often likened to the proverbial donkey driven by the application of the whip (coercion) and the carrot (economic incentive). But the whip was becoming much bigger and the carrot smaller during the late Stalin era. Now it was a question of reversing the proportions in some degree.

This meant that some propitiating gesture—some concessions—had to be made to the peasants. It is important, however, to bear in mind that such concessions as were granted during the post-Stalin era were within the framework of the existing system of collective farming. Its basic structure remains unaltered. Here again Stalin's successors followed in

<sup>8</sup> *Pravda* and *Izvestiya*, February 3, 1955.

<sup>9</sup> *Pravda* and *Izvestiya*, January 8, 1955.

the footsteps of their Master who, after all, had not disbanded the collectives when he softened his agricultural policy in the mid-1930's. Malenkov and Khrushchev likewise have not tampered with the super-collectives, resulting from the wholesale mergers, which were the crowning "achievement" of Stalin's hard agrarian policy, repeating the gigantomania of the early 1930's, which gave such sorry results that it was condemned by the Kremlin itself.<sup>7</sup>

As a matter of fact, since 1953 the Communist Party control over collective farming was further tightened. The controlling role of the state machine-tractor stations was greatly enhanced, but they still remained separate entities. The machine-tractor stations were not merged with the enlarged collectives, despite the extensive transfer of collective farm personnel to their permanent staff; though such workers still continue to be paid in part by collectives. Thus, the old dualism in collective farm management is faithfully preserved; and so are the attendant friction and inefficiency. Furthermore, several hundred new giant state farms were organized during the last two years, resembling their prototypes of the early 1930's.<sup>8</sup> As a result, the importance of the state farm sector also increased. But the collectives still predominate in Soviet agricultural economy.

Not only gigantism, but dwarfism was also given a new lease on life. Here was an important concession to the peasantry. I have in mind the small private farming of the collective farm members, so greatly prized by them. I shall henceforth call it the "private sector." This dichotomy of gigantism and dwarfism in the collective farm system appeared to be on the way out during the last years of Stalin's era.<sup>9</sup> It was saved by his

<sup>7</sup> A campaign began in 1950 for creating super-collectives, enlarging collective farms by so-called "voluntary" mergers. This campaign, by the way, was spearheaded by Nikita S. Khrushchev. It was carried out throughout the country, in regions with most diverse natural and economic conditions, in those where the farms were small, and in those regions where they were already large. As a result, the number of collective farms was more than cut in half. It decreased from more than 250,000 at the beginning of 1950 to less than 100,000 before Stalin's death. In the USSR there were, in 1954, 89,000 collective farms with an average area of more than 15,000 acres per farm. The average size of the collective increased fourfold compared with the prewar period. By contrast, the number of farms in the United States, where the trend towards larger size of farms has also been evident, decreased from 5,382,000 in 1950 to 4,782,000 in 1954, or 11 percent. Less than 3 percent of our farms have 1,000 acres or more of land.

<sup>8</sup> The state farms or *sovkozy* are owned outright and managed by the state, employing hired labor, as Soviet factories do, in contrast to the collectives (*kolkhozy*), the peasant producers pseudo-cooperatives, tightly controlled, however, by the Soviet government. See the author's *A Survey of Soviet Russian Agriculture*, U. S. Department of Agriculture *Monograph 5*, pp. 69-80. Washington, D.C., 1951.

<sup>9</sup> See the author's "Stalin's Last Testament and the Outlook for Kolkhozy During the Succession," *Journal of Political Economy*, Vol. LXI, No. 4, August 1953, pp. 291-305.

successors, for the time being at any rate. But it was not only to please the peasants that the recent policy turnabout regarding the private sector took place. The program becomes more intelligible when we recall how greatly small livestock farming contributed, notwithstanding all its shortcomings, to the recovery of the Russian livestock industry from the catastrophic decline of the early collectivization.

The relief that the new Malenkov-Khrushchev program gave to the private sector consisted in reduced and simplified taxation, reduction or abolition of compulsory delivery quotas, and an increase of prices paid by the government. A new friendly tone of official pronouncements dealing with the private sector, replaced the frigid attitude of the later Stalin period. It is symptomatic that Malenkov, in his confession of unspecified alleged errors on the agricultural front when he "resigned" from the premiership early in 1955, explicitly excluded the agricultural tax reform sponsored by him in August, 1953. This may be interpreted as a signal that the policy with respect to the private sector had not changed when the Khrushchev-Bulganin team assumed full power. But how long will this course continue? That is a question the peasants of Russia doubtless ponder. They may recall the former zigzag of Soviet policy; first, the encouragement by Lenin of the peasant revolution of 1917, followed by the harsh war communism in 1918. Then, the abrupt swing to the relatively liberal NEP policy in 1921, replaced in less than a decade by forced collectivization. Again, relaxation in the mid-1930's, followed by the tightening of the screw. When, the peasants may ask themselves, will the present, milder policy likewise stiffen? Khrushchev seems to have supplied the answer in his report of September 1953, cited above. He pointed out that the encouragement of privately owned livestock raising is of a temporary character until greater progress is made in collective animal husbandry. But livestock difficulties, as we saw, are at the very root of the softening of Soviet policy with respect to the private sector. Once these difficulties are overcome or even diminished, another reversal of Soviet policy towards the private sector can be anticipated.

Of course, the new concessions are welcome to the peasant as far as they go. Nevertheless, the stimulating effect, especially on animal husbandry, is probably dampened by the realization of their transitory character. Even more important is the fact that these concessions do not go far enough. The peasants are tied even more closely to the collective chariot. They continue to be predominantly residual claimants to the income of the collective, bearing all the risks with no control in practice over the enterprise. This can hardly appeal to the Russian peasantry, with its long history of struggle for and attachment to the land. The collective sector continues to enjoy the first priority or exclusive claim to the inputs of factors of production or resources. The private sector, of course, is ex-

cluded from large-scale capital investments—and in this gathering I need not dwell on the importance of capital investments for the efficiency of modern farming. Perhaps most painful to the Russian peasant is the divorce from the horse—often his only means of transportation. As for labor, it should be noted that the required minimum to be performed by each member of the collective was raised in 1954. As a consequence, peasants can devote less time to their own small farming.

However, the policy of increased economic incentives was not confined to the private sector. It was extended to the collective sector as well. Incomes of the collective farms were also to be increased by reducing compulsory delivery quotas, combatting arbitrary changes in quotas and substantially increasing the heretofore low prices paid by the government. Still higher prices, double or more than double of the quota prices, were fixed for the extra-quota purchases by the state. Such purchases at higher fixed prices were supposed to have constituted, in 1954, about a fifth of all grain procurements from collectives and their members, about a third of potatoes and vegetables and 40 percent of oilseeds, milk and meat.<sup>10</sup> Their proportion is supposed to increase in the future.

There were, however, offsetting factors on the debit side of the ledger. In the first place, delivery quotas for animal products set by the new program continued to be higher than those for 1950 and 1951, when they were also sharply increased. The high meat quotas doubtless interfere with the growth of livestock numbers.

Secondly, the new higher government prices, particularly for compulsory deliveries, are still low in relation to prices paid by the consumer in state retail outlets. Food retail prices are several times higher than delivery prices, despite numerous reductions in recent years. For instance, the price paid for compulsory deliveries of butter was set in 1953 at 9 rubles per kilogram (2.2 pounds) after the delivery prices of dairy products were doubled. But butter has been sold in state retail stores (when available) at 26 to 28 rubles per kilogram. Such a wide spread between the prices the state pays to farmers and those it charges the consumer, to whom it renders a notoriously poor marketing service, indicates that the farmer is still seriously underpaid, though less flagrantly than during the Stalin era. There exists a limited free retail market, where the peasants and collectives who have something to sell after state collections can obtain even higher prices for their products than are charged in state stores. However, the free retail market can only partly compensate producers for the great disparity of government farm and retail prices. The free market is largely inaccessible to many collectives and their members

<sup>10</sup> M. Moiseev, *Kommunist*, No. 11, 1954, pp. 50 and 51.

who are far removed from towns, however profitable this trade may be to nearby collectives.

A question also arises to what extent the benefits derived by the collectives, from the price increases and reduced delivery quotas, percolate to the rank and file. Increased capital investment by collectives, and possibly larger overhead for administration and the usual waste, are likely to absorb a sizable slice of the additional income. To illustrate: the total appropriation provided to implement the increase of agricultural prices was 23.3 billion rubles in the 1954 budget and slightly less, 22.5 billion in 1955; a decrease, incidentally, that seems contrary to the expected trend. But the cash capital investments of collectives were to increase from 12.5 billion in 1953 to 18 billion in 1955. In other words, nearly a fourth of the projected, and not necessarily realized, increment of the agricultural income resulting from price changes is counterbalanced by increased capital investments of collectives. There is obviously many a slip between the cup of the collective farm income and the peasant lip or pocketbook.

One other problem within the ambit of economic incentives has claimed serious attention of post-Stalin leadership. This is what Khrushchev called in his September 1953 report the practice of "pruning" the better, more efficient collectives; that is, cutting down their surpluses by forcing excessive deliveries of farm products above their normal quotas. This had been long illegal but, nevertheless, was widely practiced, in order to make up for the failure of the weak or less efficient collectives. Thus, the superior collectives were deprived of the stimulus of the "wages of efficiency"; and, possibly also and with more justice, of the differential rent and quasirents due to better land or more convenient location in relation to the market, and of better capital equipment. In order to encourage or at least not to discourage the superior collectives, the principle of stability and equality of annual delivery quotas within each district was strongly and frequently reaffirmed by the Kremlin. But there are many stumbling blocks met in the enforcement of this principle.

A similar end is served by setting the increasingly important payments in kind to machine-tractor stations at fixed rates for each operation (so much grain for each hectare of plowing, sowing, etc.), with regional variations and deductions for untimely work and a bonus for exceeding the yield-per-hectare goals. Formerly, such payments increased with the rise of the inflated biological yields, thus often also penalizing superior collectives. Incidentally, the share of payments in kind to machine-tractor stations in government procurements of agricultural products has grown significantly, especially in the case of grain. In 1954, these payments were more than double the volume of compulsory deliveries of grain. Perhaps

assurance of a steady flow of such payments may be an important, if not a decisive, reason for the Kremlin's clinging to a separate existence of the machine-tractor stations from the collectives, despite the fact that this dualism is detrimental to farm efficiency.

There is one over-all limitation to which any program of increased economic incentives in Soviet agriculture is subject. It arises from the industrial policy of the Kremlin. I have in mind the familiar issue of the pre-eminence of the heavy industry and the Cinderella role of the light industry, resulting in scarcity of goods for general consumption. For without an adequate supply of consumers' goods of reasonably good quality and at reasonable instead of exorbitant prices, a program of increased economic incentives is in danger of merely generating increased inflationary pressure. In this connection, the strong re-emphasis on the heavy industry that accompanied Malenkov's fall from power does not augur well for an economic incentive policy. So much for this problem.

The post-Stalin leadership had addressed itself vigorously to the question of bringing the numerous agricultural specialists and technicians closer to the farm and production. Steps were also taken for improving the training of skilled laborers, such as tractor drivers, and of keeping them on the farm. A campaign was even put on to channel skilled agricultural workers from the factory back to the farm. There is evidence, however, that some of the returnees were not of the highest caliber. Even Ilya Ehrenburg dwells on this point in his highly topical and much criticized novel, *The Thaw*. To be sure, the present movement from the city to the farm is small, compared with the reverse exodus that was going on since industrialization began. What is important, however, is that the steady migration of skilled agricultural labor to industry is now discouraged, and some incentives are provided to stay on the farm.

The post-Stalin administration has continued to grapple with the managerial problem on enlarged collective farms without much evidence of success. The Kremlin realizes, of course, that it is important not merely to increase the input of willing labor, but also to utilize it more effectively on the enlarged farms. This obviously depends upon management. There has continued, however, to be much evidence of wasteful use of farm labor, which was strongly reflected in the impressions of the American farm delegation to Russia in the summer of 1955. You will hear more about this from Professor Gale Johnson. I would only add, that the latest experiment to improve farm management, that of recruiting 30,000 members of the Soviet elite from the cities to assume managerial functions in the backward collective farms, after a short training and apprenticeship, can hardly inspire great confidence of success, except as a vehicle of regimentation.

More sensible are the measures adopted last spring to decentralize and

make more flexible the highly centralized and rigid planning of agricultural production.<sup>11</sup> Greater responsibility for detailed production planning, including selection of specific crops, is placed on collective farms. Khrushchev's denunciation of the old planning procedure sounds very much like criticism often leveled by non-Soviet specialists.<sup>12</sup> The aspect of crop planning that provoked the greatest ire of Khrushchev was the expansion of perennial grasses into the dry regions, which was pushed hard by the government until last year. The miserable results, as far as the greatly increased putative forage supply was concerned, doubtless could have been foretold by bona fide Russian specialists, not the Lysenkoists, if they had the opportunity. But once a certain line is adopted by the Kremlin, as in expansion of perennial grasses, all criticism except of details is taboo, until the Kremlin reverses itself. And the same is true of centralized planning. Only the future will tell, of course, whether or not the present planning reform will work. It is significant that a somewhat similar experiment undertaken in 1940 on a smaller scale has remained, as Khrushchev admitted, a dead letter. The 1940 reform provided that the collectives were to be given an over-all grain acreage allotment which they were to distribute themselves, with certain limitations among individual grains, such as wheat, rye, etc. Well, will the collectives now be allowed, for instance, a choice with respect to the planting of corn, which is being promoted so energetically by the government? I have my doubts. As a matter of fact, the Soviet press was filled recently with stories of how collectives were confronted with ready-made plans presented by local authorities. The latter, following a familiar pattern, usurped the planning function. Certainly, past experience and the general climate of regimentation are not conducive to a favorable prognosis in this matter of decentralized planning.

The post-Stalin leadership has also taken steps to increase capital investment in agriculture, mainly for machinery and other equipment for machine-tractor stations and state farms. Much of the new investment, however, is for financing the new grain expansion program, concerning which I shall say a few words presently. About a fifth of the total appropriation for agriculture in the 1955 budget was to be devoted to this project. This involved a serious diversion of resources from older regions.

Considerable attention was also given by the Malenkov-Krushchev program to the increased production and use of commercial fertilizer, for which special credit facilities were provided to collectives. In fact, the targets set up for commercial fertilizer production seem high.<sup>13</sup> At present

<sup>11</sup> *Pravda* and *Izvestiya*, March 11, 1955.

<sup>12</sup> *Pravda* and *Izvestiya*, March 21, 1954.

<sup>13</sup> The sixth 5-year plan, a preliminary draft of which was published in the Soviet

commercial fertilizer is used extensively, perhaps too lavishly, for cotton and some other industrial crops, but little for grain. Increased use of fertilizer, plus liming, in the humid regions of the northern and north-central European Russia, with their podzolic soils, would undoubtedly increase crop yields. This area has the advantage over much of the more fertile black soil zone of being largely free of the drought scourge. Yet, the crop acreage in the so-called nonblack soil area was still below prewar in 1953, while in most of the other important regions it was above pre-war.

Instead of expansion in this more humid area of crisscross landscape, the post-Stalin government chose the traditional path of expansion in the drier regions on the level steppe grasslands. More specifically, it revived the experiment carried on in the early 1930's by the Stalin administration of giant mechanized grain farming in the dry eastern regions, despite its many pitfalls and failures. In the course of two years, 50 million new acres were planted to crops on virgin or long uncropped land, much of which was previously used for grazing. Spring wheat and other grains are the principal beneficiaries of this expansion. The Soviet acreage under spring wheat alone increased in 1955 by 27 million acres, equivalent to half of our controlled wheat acreage, but, of course, much less productive than ours. Curiously, the grandiose grain program was announced in the spring of 1954, despite repeated assurances by Malenkov and other Soviet leaders that the grain problem was successfully solved.

That climatic conditions, particularly limited rainfall and frequently recurring droughts, are not favorable to reasonably high and stable yields and make farming precarious in most of this area, was obvious from the outset to all informed people. Dean Harris discussed this matter in detail. Since the men in the Kremlin also must have been aware of this situation, it is fair to assume that they rely on the multiplier of a huge acreage on these marginal lands to boost the output. But they may have been just overoptimistic.

Well, the weather in these regions behaved, in 1955, according to the usual pattern. A serious drought followed unusually favorable conditions in 1954, and crop yields slumped heavily. Perhaps an alternation of a good and a poor year may not hurt the project. It is a question, however, whether it would survive without a downward revision several successive drought years, which is a strong possibility. Thus, weather conditions during the next few years will provide a real test of the viability of the new grain expansion program on marginal land in the eastern regions.

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press on January 15, 1956, calls for an increase of commercial fertilizer output from 9.6 million metric tons in 1955 to 19.6 million tons in 1960. In 1950 it was 5.5 million tons.

Climate, as we have learned from Dean Harris, is also a serious obstacle to another pet project of Khrushchev—the vast expansion of the corn acreage. This was undertaken to bolster the lagging forage supply, which has been one of the persistent weak spots in the weak Soviet livestock economy. Although much has been written or said over a period of many years about the desirability of increasing corn production in the Soviet Union, nothing happened until 1955. Last spring, in accordance with the edict of the Kremlin, inspired by the example of the United States, the acreage under corn quadrupled and exceeded 40 million acres. It replaced in part the traditional Russian feed grains, barley and oats, as well as low yielding grasses and some summer fallow. A further increase during the next few years was originally planned to bring the area to not less than 70 million acres, or only about 10 million acres less than the 1955 corn acreage in the United States. Khrushchev admitted, however, that much of the Soviet corn will not mature as well as corn does in the United States because of the short Russian growing season.<sup>14</sup> A great deal of corn in the Soviet Union will therefore be used for silage or green fodder, and not grown for grain as in the United States. There were many indications of lack of enthusiasm on the part of the Russian farmer for corn and considerable cultivation and harvesting difficulties were reported in 1955. There are some hints of a sobering reappraisal of the corn venture, to which the exchange of agricultural delegations between the United States and the Soviet Union during the summer of 1955 doubtless contributed. For instance, in the leading editorial of *Pravda*, of December 9, 1955, the paper takes to task the press, singling out particularly its sister paper, *Izvestiya*, for "one-sided" and "giddy" optimism in reporting on the corn situation. The editorial characteristically urges that "It is necessary that the Party organizations inculcate faith in corn in every collective and state farm." Many of the shortcomings, such as lack of know how, fertilizer, machinery and suitable varieties, can perhaps be overcome in time. But the central fact remains that climatic conditions are not favorable to the growing of corn in Russia on so huge a scale in competition with other crops, because it is either too dry or too cold.

It is true that the Soviet government often disregards climatic limitations in its agricultural planning. This usually has painful consequences. I have already alluded to the perennial grasses in the dry regions. This costly mistake was finally corrected. There was, among others, also the extension of cotton into nonirrigated regions of European USSR, much farther north than it is usually grown. Dismal results led to the abandoning of this project, except for a small acreage. I wonder whether the corn program eventually will not experience a somewhat similar deflation.

<sup>14</sup> *Pravda* and *Izvestiya*, February 3, 1955.

The evaluation of the new Soviet agrarian program is handicapped by the meagerness of published statistical data. Certainly the expansion on marginal lands and the corn project have all the earmarks of a crash program and appear to be less realistic than the earlier "new look" measures—a sort of a throwback to Stalinist policy. All indications point to the fact that the increase in small grains and corn production was not commensurate with acreage expansion. It is symptomatic that the recent major official pronouncements regarding agriculture, as in, for instance, the traditional November anniversary speech by Kaganovich,<sup>15</sup> and in the budget report for 1956 by the Minister of Finance, Zverev,<sup>16</sup> were, contrary to the usual buoyant tone, muted.

No doubt, the Soviet agricultural progress was hampered, as was pointed out earlier, by unfavorable weather conditions in 1953 and 1954, in the Soviet granary in the south, and in 1955 in the east and northwest. A series of successive good harvests like those of 1925 and 1926, or of 1909 and 1910, or bumper crops like those of 1937 or 1913, would automatically brighten the agricultural picture. Apart from this, while there is some evidence of a slight improvement, the experience of a quarter of a century of the Soviet collective farm system offers little ground for believing that the chronic weakness of Russian agriculture will be quickly remedied under the present or even a somewhat streamlined institutional framework of Soviet agrarian collectivism. But let me close with a word of caution. Even if collective agriculture is destined to remain what has often been called the Achilles heel of Soviet economy, it would be dangerous to forget that Achilles still could use his heel effectively for his own purposes.

Postscript: On March 10, 1956, after this paper went to the printer, an important government decree appeared in the Soviet press, dealing with the revision of the collective farm charter and related matters. The gist of this decree is that, under the guise of encouraging initiative at the grass roots level, it actually will again tighten the screw on the private sector in the collectives—a possibility intimated earlier in the paper.

<sup>15</sup> *Pravda* and *Izvestiya*, November 7, 1955.

<sup>16</sup> *Ibid.* December 27, 1955.

## EYE-WITNESS APPRAISAL OF SOVIET FARMING, 1955

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THE trip that I made as a member of the American Agricultural Delegation to the U.S.S.R. during the summer of 1955 was a conducted tour. The particular farms that I visited cannot in any sense be considered a random sample of Russian farms. Only one of the more than 30 farms visited by our group was selected by us. The rest were selected by the Soviet authorities. Most of the farms that we visited were substantially better than the average of the U.S.S.R. However, some farms were near the average for the area in which they were located and we did travel two or three thousand miles by car in farm areas. Thus one has some possibility of putting what he saw in some kind of perspective, but one must also say that he cannot be certain as to the accuracy of that perspective.

I do not intend to give what might be called a systematic appraisal of the problems and prospects of Soviet agriculture. I shall try to give you a number of impressions that I have as a result of my five weeks' trip. These impressions represent nothing more than an honest effort to report some of the things that I witnessed or heard.

### I

Many westerners have interpreted the attention that has been given to agriculture in the speeches and decrees since late 1953 and the announcement of the reasons for Malenkov's resignation as evidence that the present Russian food situation is extremely critical. If these interpretations are carried so far as to imply that the Russian people are on a near starvation diet, what I saw would not support so strong a conclusion. The people I saw on the streets, in the factories and on the farms did not appear to be underfed. Other evidence is that there seemed to be plenty of bread available in the stores. Since bread and potatoes plus other grain products supply about 75 per cent of all calories consumed by the Russians, the general availability of bread means that people are probably not going hungry. The bread is relatively cheap and any employed person can afford to buy any amount of bread that he desires, particularly if he is willing to eat rye bread. Most other food items, such as fresh milk, meat, and fruits and vegetables were not available in the state food stores I visited. However, these items were available in the free or collective farm markets at prices substantially above the state store prices. However, the margins between state store prices and free market prices, which ranged about 25 to 150 per cent above state store prices, hardly indicate a rear starvation situation.

However, there does seem to be considerable concern that the over-all food situation has not improved since the beginning of the present decade. Apparently the 1950 grain crop has not been equalled, though the 1955 crop may be as large. In both 1953 and 1954 there were serious crop failures in major grain regions, the 1953 failure coming in the east and the 1954 in the European part of Russia. The amount of grain that has been fed to livestock in recent years has been very small and unless there are significant increases in grain and feed output in the near future, there is little or no prospect for the improvement of the Russian diet. When these and other facts are confronted and when it is remembered that there are about 3 million new mouths each year, it can be seen that the present rather tight food situation might be transformed into a crisis in 5 or 10 years.

## II

Grain and crop production as I saw it in the summer of 1955 was better than I had expected it to be. By this I mean that the cultivated crops had been well tended and the fields were free of weeds; the small grain fields were generally free of weeds and the crops had apparently been sown on time on reasonably well prepared seed beds, and the harvesting was being done on time and there seemed to be little loss of grain from the combines. I know relatively little about cotton production, but the irrigated cotton fields that I saw compared favorably with the few similar fields that I have seen in the U.S. On one trip of about 100 miles from Odessa I did see mile after mile of small grain fields that were infested with weeds and which as a consequence would yield quite poorly. But this was the exception; perhaps in other years when growing conditions were less favorable before and after seeding this condition is more general.

As you undoubtedly know, Russia is now to become a corn country, rivaling even the United States in total corn acreage. We saw corn everywhere, along the Volga River where rainfall does not exceed 12 inches, near Moscow with its short growing season and in Siberia in dry land farming country. The corn had been planted so that it could be cross cultivated; since we saw few planters that could plant it in this way, it was evident that much of the corn had been planted by hand. The Russians are great believers in cultivation, much of the corn being cultivated a total of six times. It must have come as a shock to the Russian delegation in the U.S. to learn that our farmers were now giving up the check-row planting of corn and that they cultivated their corn as seldom as possible and hardly ever more than three times.

So far as I could tell the Russians do not have hybrid corn in any significant quantity. We visited upwards of a dozen places where hybrid

corn would have been produced if such production existed—agricultural institutes and colleges, experiment stations, seed selection stations and state seed grain farms—yet we did not see a single field where hybrid corn was being produced. Only at one of these places was there even a claim that they were producing hybrid corn. This was on a state grain farm that had 3,000 acres of corn for sale as seed to collective and state farms and it was said that on 100 acres hybrid seed was being produced. I didn't see it and I suspect that what was done was the crossing of two open-pollinated varieties. At many of the farms we visited we asked what kind of corn seed had been used and the answer was always some open-pollinated variety, frequently a variety that had come from the United States.

The blame for the lack of hybrid corn can probably be given to Lysenko. An official of the Ministry of Agriculture, who was not a devotee of Lysenko, told me that work on the development of the inbreds required for hybrid seed was well underway in the late twenties. But Lysenko ordered the work stopped on the grounds that according to his theories this was not the correct way to conduct breeding work.

However, I do not believe that Russia will be able to obtain from hybrid corn the miracles that Krushchev has attributed to hybrid corn in the United States. Apparently, as a result of long training, Krushchev and his statisticians have grossly overestimated the gains we have made from hybrid corn. This was done by using the drought years of the thirties as the prehybrid corn base period and 1953, the year with the highest yield on record, as the current base, in estimating the effect of hybrids on yields.

But the problem is more complex than that. In areas in the United States that are most comparable to the U.S.S.R. we have obtained very modest increases in corn yields. This has been true in North and South Dakota and, to a somewhat lesser degree, in Nebraska.<sup>1</sup> Russia has only about 10,000,000 acres of crop land in the Kuban that compares with any part of the Corn Belt and this to northeastern Nebraska. In areas of limited rainfall and relatively short growing seasons, hybrid corn has not worked miracles in the United States and there is not much reason to believe that Russian experience will be very different.

I do feel that crop production suffers from the failure of the Russians to specialize—to concentrate on specific crops in the areas that are best adapted to them. If more corn is desired, the corn should be concen-

<sup>1</sup> The average corn yields for 1920-29 and 1940-49 for the three states were as follows: North Dakota, 21.0 and 22.4; South Dakota, 24.7 and 25.8; and Nebraska, 25.7 and 28.1. In Iowa the yield increased from 40.2 to 51.2. Some of the increase in corn yield in Nebraska is probably explained by the different area distribution of corn, since the corn acreage declined in the drier parts of the state between the two periods.

trated in the Kuban and in the Ukraine with the best growing conditions. Instead corn is being planted everywhere and the corn expansion is not significantly greater in the areas where corn has the greatest comparative advantage. There is a general tendency to make each area as self-sufficient as possible. In part this may be due to the lack of adequate transportation, since few farm products (other than grain) move long distances from their point of origin.

The mechanization of agriculture still has considerable distance to go. Most of the field operations for the small grains seem to be rather fully mechanized. However, machinery must be used quite intensively. For example, each combine apparently has to harvest about 750 acres each year. In order to complete the harvest in minimum time, the grain is not cleaned adequately at the combine and a great deal of labor is used at the grain cleaning floors to get the grain in shape for delivery and storage. The grain cleaning is mechanized in only certain limited respects and Krushchev has stated that "considerably more labor is consumed on postharvest processing of the grain and the harvesting of straw and chaff than on all preceding operations is raising grain crops."<sup>2</sup> From what I saw, I see no reason to doubt this statement.

### III

Although I was favorably impressed with the grain output per acre, this was not the case with livestock production. This does not mean that I saw no herds of relatively high producing milk cows or no hogs of good quality. I did. Obviously we visited a number of model farms, but with one exception, the milk yields on these farms were about the average for major dairy states such as New York and California. Most of the livestock that I saw was poor in quality and many of the cattle seemed to be underfed. It is not hard to believe that average milk yields on collective farms are about 2,300 to 2,500 pounds per year, and we in fact visited farms where the reported yields were substantially below this.

About sixty per cent of the milk cows in the Soviet Union are now owned by the individual peasants who are limited, in most areas, to one cow per family. Thus milk production occurs at the extremes of a distribution of production units in terms of scale. On the one hand, 60 per cent of the cows are in production units of minimum size, namely one cow. The rest are in units ranging upwards from perhaps 40 or 50 to several hundred cows. Thus I suspect that the Russians have the worst of all possible worlds with respect to scale. The disadvantages of the extremely small unit are well known, but some comment on the larger units may be

<sup>2</sup> See *The Current Digest of the Soviet Press*, May 5, 1954, p. 8 for translation from *Pravda*, March 21, 1954.

mentioned. In several farms that we visited, special summer quarters were used for milk cows. These summer quarters were apparently required to get the cattle out on pastures and near enough to the sources of green feed. Although the capital investment in summer quarters was not as high as for year-round building of the traditional type (but as great as the milking parlor and open shed buildings now coming into use in the United States), the investment required was quite substantial. In some cases the distances from the villages were so great that living quarters for the milk maids had been built. The necessity for the summer quarters is more a function of the size of the farm as a whole, than of the dairy herd.

#### IV

All of the members of our delegation were surprised at the large amount of labor that was being used in conjunction with every farm operation. While I had some rough idea of the total number of farm workers in the U.S.S.R. I still found it somewhat difficult to imagine what all of these workers do. This is especially true since the tractor power available is about the same as we had in the thirties and there is a greater number of combines.

On the farms that we visited in the Ukraine there was about one farm worker for 8 or 9 acres and in the Kuban one worker for 9 or 10 acres of crop land. Only in the dry-land areas of western Siberia and northern Kazakhstan, where there is relatively little livestock, did the ratio of labor to land reach approximately the average of the U.S. In the U.S. we have about 50 acres of cropland per worker; in the Russian areas referred to there were about 40 acres per worker. But in a comparable area in the United States, such as North Dakota, there are about 225 acres of harvested land per worker.

On the whole, I have the impression that in Russia the output per worker in agriculture compared to output per worker in industry is much lower than in the U.S.<sup>3</sup> This crude statement assumes some concept of physical labor input and comparable outputs, weighted by approximately U.S. prices or at least by non-Russian prices. But if we accept the relative price structures of each country and calculate the labor inputs and outputs in dollars for the U.S. economy and in rubles for the Russian economy, the differences might not be very great. This is true because the relative prices of food are so much higher in the U.S.S.R.

The wages paid to workers on state farms seemed to average about 550

<sup>3</sup> By this statement I mean the following:

Agricultural output per worker—U.S.S.R.      Agricultural output per worker—U.S.  
Industrial output per worker—U.S.S.R.      Industrial output per worker—U.S.

rubles per month, while the wages paid to factory workers was about 750 rubles. This is a very small difference, compared to differences that exist in the United States, Canada or western Europe. Part of this difference is eliminated by the greater importance of private plots for the farm workers and the absence of costs of getting to work. The employees of machine-tractor stations have higher earnings than state-farm employees and may have real earnings that approach or exceed those of factory workers.

While I have the impression that in the areas we visited the peasants who belong to a collective have incomes equal to factory workers, this is a difficult statement to prove. My impressions may be biased by the fact that all collectives visited were at least average or better in terms of productivity and income. But even on the poorest of the farms that we visited, which were probably about average for the U.S.S.R. as measured by milk yields per cow and cash income per hectare, the payments from the collective farms were equal to about a third of the average factory wages, if grain is priced at 2 rubles a kilogram. For the farm income to equal the factory income it would be necessary that the private plot income be about 6,000 to 8,000 rubles per year, since there is more than one worker per household. If the family had both a cow and a sow and raised a calf and four pigs each year, the income from the plot would be about 8,000 rubles at free market prices.

But perhaps the most convincing evidence of the near equality of farm and nonfarm incomes is that the farm population and work force has increased over the past two years, halting a decline that has lasted for more than two decades. We were told that the number of able bodied workers in agriculture increased by 1,500,000 in 1954. On the farms we visited we were told of rather significant increases in the number of families and workers. Of course, the increase has not been uniform over the U.S.S.R. In the European part, the rate of increase has been higher in the south than in the north, while the increase in the east has undoubtedly been much greater than in the west. While some of the movement of workers to the new lands area may have had an element of compulsion in it, I doubt that this was an important factor in the Ukraine and Kuban and Volga areas.

If the labor force on farms continues to increase in response to the more favorable incomes and the increased labor needs resulting from the corn and new land programs, the conflict between farm and industrial production will be of real significance. It will be interesting to watch how long the favorable impact of recent policy changes on farm incomes will be allowed to continue. One way out would be to increase nonfarm wages or to increase delivery requirements, either at obligatory prices or at the

purchase prices, so that more farm products would be available at state-store prices. I am not predicting that either of these changes will occur, but neither will I be much surprised if they do sometime within the next couple of years.

## V

A few comments on the level of living in the U.S.S.R. may be in order. I find it difficult to make meaningful comparisons because my own experience has been with high-income countries. I am also greatly puzzled by a special phenomenon for which I can find no explanation. When you move from one farm area with relatively high incomes to another area with low incomes in the United States, it is easy to observe the difference in terms of quality of housing, the clothing, the age and type of cars, the number of television sets, automatic washing machines and so on. But as I went from one farm to another in Russia I was quite unable to detect the large differences in apparent income in terms of the quality of housing, clothing, furnishings in the houses, or the general appearance of the people or the village. The only apparent difference seemed to be in the number and quality of farm buildings and in the size and quality of the palace of culture. The reason for these last differences is fairly obvious—a certain share of the money earnings of the farms must be invested.

Why didn't differences in payments from the collective farms of the order of four or five to one reveal themselves in a way that could be detected readily by an outsider? A part of the reason is probably that a large share of the food intake comes from the private plots on most farms. This would be true of most foods with the possible exception of the grains, which are received by distribution from the collective farms. Part of the reason may also be that the kinds of consumer goods that would be obvious to the visitor are simply not available in quantity in the U.S.S.R. Here I refer to such things as washing machines, gas or electric stoves. But clothing, which is very high priced, does seem to be available to a degree that a farmer with cash and some time for shopping should be able to acquire it.

I am also puzzled that the difference in income did not show up in the size and quality of houses. In fact, some of the poorest housing that I saw was on a very high-income and model farm near Moscow.

The only exception to the above statements was in the cotton producing areas of central Asia. But comparisons are difficult because of the different modes of living of these essentially Asiatic people and the more westernized Russians. There were more cars on the farms in this area—on one farm 10 per cent of the families owned cars while the general rule is none or one to three cars in villages of several hundred families. One also saw sewing machines in the homes of some. But since such homes, by

tradition, have little in the way of furniture other comparisons cannot be made.

On the whole, I felt that farm housing compared favorably with urban housing. Except for the small proportion of urban people who live in apartment buildings constructed since the end of World War II, urban housing can only be described as miserable. Many urban families, perhaps most, still depend on community wells or hydrants and outside toilet facilities. In addition, they live in more crowded circumstances, both with respect to the amount of space inside the house and outside. Many urban families apparently also share kitchens, though I have no direct evidence of this. The relative openness of the rural housing must be attractive to many urban families, though the paucity of community facilities and shopping and the ever-present mud during the spring and fall and the isolation caused by snow and cold in the winter are undoubtedly serious drawbacks.

But to return to the general question of comparative levels of living in U.S.S.R. and the U.S., in a rough sense I believe that aggregate output would have to increase at least four fold before the per capita content of the U.S.S.R. level of living could duplicate that of the U.S. This is based primarily upon observation of the content of consumption, upon labor productivity in agriculture, wage rates and some rough price comparisons. I doubt if the purchasing power of the ruble for consumption purposes much exceeds 6 cents. The average monthly wage of factory workers is about 750 rubles or perhaps \$45. Even if the purchasing power is as high as 10 cents, which I find it hard to believe, the earnings would be \$75 or about a fifth of the U.S. average. If one adds a quarter for social services that are not available in the U.S., such as medical services and nurseries, the earnings are still about one fourth of the U.S. level. And it should be noted that the Russian factory worker is probably higher up in the urban income scale than the American factory worker.

## VI

I would like to comment briefly on what I saw with respect to the two great programs for expanding agricultural output—the corn program, and the virgin and idle lands program. I must admit that I was surprised at the number of acres of corn that I saw on the trip. I did not believe, and I made the mistake of saying it, that the Soviet Union would actually increase the corn acreage very significantly. In contrast to the new lands program, the corn program appeared to be a program based solely upon exhortation. This has been fairly common in previous agricultural programs, and the output has generally about equalled the input. The state was going to put relatively little into the corn program; machinery

wasn't available for many aspects of corn planting, cultivation and harvesting; and the collective farms were to receive little or no aid in constructing the necessary silos. But the corn was there, apparently 40,000,000 acres or about four times as much as last year. And there were many new silos on almost every farm that we visited.

If a nation is interested in maximizing the output of feed per unit of land, the corn plant has much to commend. In temperate climates, if the entire corn plant is used, corn will probably outyield any other plant and will yield about as much starch (more protein) than the root crops. This seems to be true in cold climates, dry climates, or in relatively hot climates. But the difficulty with corn is that it requires much more labor and machinery than the small grains. As a result, we do not grow corn unless it will yield almost twice as much grain as the competing small grains.

I saw corn being produced near Moscow that would not produce ears this year; I saw corn in western Siberia that would yield no more than 3 to 5 bushels to the acre if harvested as grain. Corn acreage is being expanded everywhere. There is apparently no attempt to expand it relatively more in the areas with the highest relative yields.

Since the corn is to be harvested as silage, with the ears separated from the stocks so that hog feed will be produced, output per acre will be higher than it would otherwise have been. But the return to labor for the additional effort will be very low indeed, especially in the drier areas. Furthermore, recent press reports have indicated that the harvest is proceeding very poorly in many areas because the harvest labor requirements have exceeded the available labor input.

An additional facet of the corn program may be mentioned. Milk yields were substantially higher this year than last year. Part of this is due to the fact that last year was a year of drought in much of western Russia. But part of the increase can be attributed to the availability of corn as a green feed in July and August. Large areas of corn were cut for cattle feed during this period. I suspect that in most years cattle have not had enough feed after the spring growth of grass was eaten and that milk yields were seriously cut and never recovered during the same lactation period. Now the corn meets this deficiency. However, if the Russians allow too large an increase in livestock numbers, they may find themselves very short of feed at a different period of the year, say in the late winter months.

I did not see much that would serve as a basis for appraising the new lands program and its prospects. The area that I visited was part of a well established farming area. The newly plowed lands were similar to lands that had been farmed for several decades, but had not been farmed because of a lack of manpower and machinery. Little moisture had been

received this year, though the crops were undoubtedly aided by the carryover of moisture from the previous year. This year's yields will be less than half of last year's. In northern Kazakhstan where the other part of our party visited, crops were much more affected by the drought which seems to have blanketed most of the new lands area this year. Last year the yields were about 15 bushels per acre and this year from 2 to 6 bushels per acre.

I am somewhat puzzled by what our group was told in Kazakhstan and what has since been mentioned a number of times in the Russian press, namely that the yields on new lands were much higher, say 6 bushels per acre, than on lands that had been plowed before, even twenty years before. What this may mean is that these lands soon lose their ability to retain moisture once the original cover is disturbed. If true, the yield prospects on much of this land may prove to be quite disappointing to the Russians.

## VII

Russian agriculture presents one with paradoxes on all sides. You have bigness carried to the extreme in many things—farm sizes, machinery, sows, boars, barns and fields—but alongside this they have minute peasant farming on the small plots. Mechanization has been emphasized in field operations, but other aspects of grain production have been mechanized little if at all. There is centralization of marketing and production decisions, but free markets continue to have a very important role in feeding the city population and in providing incentives for rural people. Labor specialization is carried to an extreme on many farms, but there is little tendency to have specialization in crop production.

I must confess that after my brief acquaintance with Soviet agriculture that I am hard pushed to explain why it works as well as it does, rather than being puzzled by why it has performed rather poorly.

## DISCUSSION: THE RESOURCES AND PERFORMANCE OF SOVIET AGRICULTURE

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Before undertaking my pleasant assignment, I want to express my deep appreciation for the honor of being invited to participate in the program of the American Farm Economic Association. I consider it a rare privilege to discuss three excellent papers of such eminent American scholars on a subject so close to my professional interests. Since the speakers have said nearly all that is pertinent, I can merely amend their observations with minor disagreements on details.

Dean Harris in his paper gives a clear analysis of the possibilities in the Soviet Union for an expansion of the cultivated area toward the north and toward the dry interior of the country. This analysis is based on indisputable agroclimatological facts, and I fully agree with Mr. Harris's conclusions. But one important factor perhaps should be analyzed more closely—namely, the impact of agronomic measures on the planned expansion of the cultivated area by the New Land Campaign. What strikes me in this connection is that the Soviet authorities obviously have changed their attitude toward the agronomic measures to be adopted in dry areas. For a critical appraisal of the New Land Campaign, it is quite important to find out what cropping scheme the Soviets have in mind to adopt on their new lands. Dean Harris did not clarify this point. Professor Johnson, too, did not deal with this question. From the report of an English expert who visited the new land region with the British delegation in October 1955, I got the impression that Soviet experts themselves are not quite clear about this problem.

To elucidate why I stress this point, I draw on practical experiences that I had at a time when I worked in Soviet Russia as manager and agronomist in the 1920's on large-scale farms leased as "concessions" to German corporations. Although that was nearly 30 years ago, I think that agronomic experiences remain valid unless there are deep changes in agronomy. My practical experiences in farming in Russia were gained first in the Transvolga district not far from Uralsk with an average rainfall of 11 inches, and later in the Kuban district in the North Caucasus. The first district is now a part of the new land region, and the second district is well suited for corn growing; the experiences gained may perhaps contribute something to the discussion of both problems.

When work was started in the Transvolga district on an area of 25,000 hectares, we proceeded in the same way that the Soviets now do on the new lands—namely, plowing up virgin or long-abandoned arable land with big machinery and growing spring wheat on it. We concluded that it would be a mistake to continue wheat on the same land for more than two consecutive years. In the third year it was necessary to use other land, or to fallow the land for a year and in the fourth year to grow a different grain, such as oats or millet, partly undersown with perennial grasses. The land had to be left under perennial grasses for at least five years after that, or simply left idle. This results in a crop rotation similar to the so-called *travopolnaja sistema* or field-grass system of the Russians or the dry-farming system of the United States.

It is significant that the Soviets themselves for many years strongly advocated the cultivation of perennial grasses for all areas where rainfall is insufficient, and only recently changed their official attitude, ceasing

to support the general adoption of the field-grass system in semiarid and other areas of insufficient rainfall. The question arises as to the reasons for this unexpected about-face. Obviously the cultivation of perennial grasses had not yielded satisfactory results. This comes as no surprise, because under the climatic conditions of dry areas, grasses sown in pure form or under a cover crop often either do not germinate or after one or two years die out. Furthermore, the field-grass system was also extended to unsuited areas such as the winter-wheat region where it resulted in extensification of farming. Nevertheless, my practical experience has convinced me that under the conditions of the new land districts the soil structure is the most important factor. This point has also been stressed by Mr. Harris. The only way to preserve the natural structure is to leave the soil undisturbed for several years after a short period of cultivation. Even unsatisfactory yields of perennial grasses will be better than continued plowing and cultivation. If perennial grasses yield too little, the land should lie idle for not less than five years.

Of course, practical experiences of this kind may be out of date if there are new and striking achievements in agronomy. Hence I have studied carefully the Soviet press and literature to discover the reasons for the shift away from perennial grasses and from the field-grass system. I could not, however, find any convincing arguments showing that Khrushchev's New Land Campaign is actually based on new agronomic achievements or discoveries. Mr. Volin mentioned in his paper that the cultivation of perennial grasses in the dry regions was a mistake which was finally corrected. I think that in most cases the mistake was not the cultivation of perennial grasses but their cultivation without observing the proper agronomic rules. I would like to ask whether Mr. Harris or Mr. Johnson could find out what the Soviets have in mind with respect to the future cropping scheme on their new lands, and what they both would suggest as the best agronomic methods, if the American experience with dry farming could be taken as an analogy.

Mr. Harris cited a Soviet source saying that only after two or three decades of noncultivation the natural vegetation has sufficiently restored the organic matter and structure to the soils to permit another short cycle of cultivation. This may be true for depleted soils but not for soils which are affected by only a short period of cultivation. Generally, I believe, the period of noncultivation could be much shorter, say five to ten years, if during the cultivation period the agronomic rules are correctly observed. In summary, my judgment is as follows: If the Soviets will take care to stop continued cultivation in time, they may avoid disastrous consequences such as large-scale wind erosion and destruction of soil fertility for a long period. This would mean, however, that after two or three years

of initial great expansion, the gain in grain area would be reduced to nearly one-third of the plan, i.e., to 10 million hectares. This would still represent—even with modest yields of, say, 7 to 10 bushels per acre—a substantial improvement in grain production, but it would fall far short of the goal.

The papers of Mr. Harris and Mr. Johnson have confirmed my skeptical view with regard to the New Land Campaign. This does not mean, however, that I expect it to become a complete failure. Mr. Harris has indicated that while the absolute physical limits of cultivation have not been reached, the economic limits have doubtlessly already been passed in many areas. Using these terms in a little different way, I think that with regard to the significance of the economical limit, the rules of Soviet economy are different from those of a free economy. Under Soviet conditions the physical limit for grain production is a yield per acre below seed requirements. If, for instance, approximately  $1\frac{1}{2}$  bushels of seed is needed per acre, then any yield beyond this may be considered a gain from the standpoint of State planning, even if produced very uneconomically.

It may be questioned whether the grain consumed by human labor required per acre of grain production should not be considered when determining the physical limit. Since this grain consumption would also appear, if the respective laborers were not required for additional grain production, it seems that for totalitarian planning it can be left out of calculation. Of course, if the value of grain produced from a certain acreage is lower than the value of total expenditures invested on this acreage, the production would be uneconomical also under Soviet conditions. But this economical limit can be neglected in totalitarian planning, if for political or other reasons the need arises to push forward one branch of economy at the expense of other branches and, finally, at the expense of the average standard of living of the whole population. Having in mind these peculiarities of totalitarian state planning, we come to the conclusion that grain production on new lands can continue, even if in the long run it remains below the economical limit but exceeds the physical limit.

Mr. Harris in his paper has also given a lucid analysis of the natural prerequisites for the fulfillment of the huge new Corn Program of the Soviets. He has indicated the climatic regions suited to corn production. My experience with corn cultivation in the Kuban district convinces me that there are remarkable possibilities for an expanded and more intensive corn cultivation in this and various other districts of the Soviet Union. But from Soviet data and from Mr. Johnson's report, we know that at present corn is grown also in many districts outside the natural corn region.

Furthermore, Mr. Johnson points out that apparently no attempt is being made to expand corn cultivation relatively more in high-yield areas. Mr. Harris has correctly stated that in the absence of suitable conditions for good grain-corn production, the Soviet leaders are stressing the growth of corn for forage and silage. But it occurs to me that somewhat more could be said on the agronomic side of the problem, the more so since American agriculture has had more experience with corn cultivation than perhaps any other country.

Having had only modest experience in corn cultivation in Russia, Rumania, and Germany, I would say that corn for grain and corn for silage are two rather different items. From the agronomic point of view, one should know before sowing for what purpose corn is to be grown. The feed value of corn sown in the usual way for harvest as grain, but then used for silage, will be lower than the feed value of corn sown from the beginning for green forage or silage, i.e. with the right density of sowing.

Mr. Johnson can probably answer two questions: (1) Can unripe corn, harvested as he describes it, with the ears separated from the stalks, be utilized with nearly the same effect for fattening pigs as ripe corn? (2) Can corn harvested for green fodder or silage before forming cobs be utilized for fattening pigs, or only for fattening cattle? The Soviets avowedly want to copy the American example of the Corn Belt and increase their hog production with more corn. But can this be achieved in districts where corn is not likely to mature? It is still a question whether the corn grown in unsuited districts will even reach the status of milk ripening. If corn is grown in such districts in the usual way for green forage or silage, then the sensational features for this part of the Corn Program would disappear. What would remain in these districts would just be an increase in the fodder acreage but not an increase in grain production. There is still the question whether corn is the best suited crop for producing more green and silage fodder or whether other fodder and silage crops, such as sudan grass, sunflowers, sorghum, and others, are more suited.

Since the Corn Program generally is not meant for new lands but mainly for areas already under cultivation, other crops grown in these districts must be partly replaced by corn. If corn production, be it for grain or for silage, does not have the great expected effect—and this may be particularly true in the beginning while corn cultivation is still relatively new—the loss caused by the restriction of the traditional crops may be greater than the gain in corn. In this connection it is noteworthy that the regions suited for corn are almost the same as those for sugar beets. But in the last few years the bottleneck in sugar-beet production in

the Soviet Union has been its high labor requirement. Corn also requires a relatively high labor input. In this respect corn and sugar beets are competitive crops. This is another point that makes it difficult to share the high expectations of the Soviet government in its new Corn Program.

I agree with Mr. Harris that the possibilities for an extended cultivation of corn for grain are geographically restricted in the Soviet Union. He mentioned correctly that new achievements in plant breeding might expand such possibilities. But this takes time and is not of practical importance for the next few years. One of the first prerequisites for utilizing the presently existing possibilities will be that farming rules are well observed, including the adoption of good seed. It may be mentioned in this connection that Soviet Russia's first Five-Year Plan provided for an expansion of the corn area until 1932 to 10 million hectares, but actually the corn area decreased from 4 million hectares to 3.2 million in 1935. This complete failure of the first big corn program was due to the fact that the rules for proper cultivation were not observed. Corn was sown on land insufficiently prepared, or sown too early, or poor seed was used. This is another indication of the serious importance of farming practices to the potential success of the new Corn Program.

Mr. Volin states that the Soviet government has a tendency to disregard climatic conditions in its agricultural planning. This is an interesting statement. It may seem unbelievable that far-reaching decisions in agriculture such as the New Land Campaign or the Corn Program should be taken by the Soviet leaders without thorough study of all possible implications and without utilization of all available expert advice and knowledge. But it is one of the peculiarities of Soviet planning that detailed technical matters such as agronomy or animal husbandry are sometimes decided by the top echelon of government. In other countries also it is not unusual for statesmen to deal with agricultural problems and decide upon important questions of agricultural policy without being experts in this field. But it is unusual that statesmen should decide upon details of agronomy. They cannot be expected to have expert knowledge in these fields. If their expert advisers cannot influence them in the right way, they may arrive at faulty conclusions and wrong decisions of great consequence.

A few words about Mr. Volin's remark on the expansion of Soviet agriculture in the drier regions: It is significant that the Soviets in the two sensational parts of their new agricultural program—the New Land Campaign and the Corn Program—are aiming at quite spectacular achievements, instead of a gradual development and intensification of agriculture in the old districts along lines of experience. This is, perhaps, as typical for the mentality of the Soviet leaders as it is for the peculiari-

ties of the existing agricultural system. The Soviets are fond of big machinery. But big farm machinery points toward application in the great plains. More emphasis is placed upon improvement of agriculture there than on intensification of farming by means such as fertilizer or better animal husbandry in the central and northern districts where, probably, the greatest dormant resources of Soviet agriculture are to be found.

In respect to farm income, I am surprised by Mr. Johnson's appraisal. He admits that obviously the output per worker in agriculture compared to output per worker in industry is much lower in Russia than in the United States. But Mr. Johnson argues that the differences actually might not be very great because the relative prices of food are so much higher in the U.S.S.R. This, however, would be true only if we take high market prices as the norm and as the basis for calculation. I have the impression that Mr. Johnson greatly overestimates the role of free prices in the Soviet farm economy.

There are great regional and seasonal differences in the free market prices. Certainly, there are some markets with extraordinarily high prices. But only a limited number of kolkhoz farms and only a small part of the millions of kolkhoz peasants can regularly use such possibilities. In fact, this is exactly the reason why the prices are so high in some localities. It would be a mistake to take such extraordinary prices as the basis for calculating the value of the whole produce sold on free markets or for calculating the value of earnings in kind. If we take ordinary market prices, I do not think that the relative prices of food are so much higher in Soviet Russia, compared with the United States, as Mr. Johnson suggests. The ordinary market prices do not differ much from official retail prices for foodstuffs of equal quality. The retail prices may, therefore, be used as a basis for comparison.

Since 1953, it is true, some procurement prices have been raised and some procurement quotas have been reduced. But, as Mr. Volin says, it would be a mistake to believe that the net gain from these changes has led to a corresponding rise in average income of kolkhoz members. An increased income of kolkhoz farms does not necessarily mean a corresponding increase in the average income of kolkhoz members. The greatest part of the additional income of kolkhoz farms is used for investments and other collective purposes and does not go to the direct benefit of individual kolkhoz members. Furthermore, a part of the possible gain in cash income is offset by higher demands for "voluntary" over-quota deliveries to state institutions in excess of compulsory deliveries. These extra deliveries are paid at prices that are higher than the procurement prices but lower than the free-market prices.

The procurement quotas for the private plots, it is true, have also been reduced. But the kolkhoz member cannot use his private plot to produce as much as possible for the free market, because his obligations for collective work have greatly been raised and he cannot grow enough fodder on his plot to expand animal husbandry to the permitted limit. Mr. Johnson assumes that the average family in a kolkhoz has both a cow and a sow, and raises a calf and four pigs each year. That this is too high a figure is evident. The total number of pigs in private use according to the latest Soviet statements was approximately 16 million head in October 1954. If we deduct from this the number of pigs in the hands of urban people, state farm laborers, and others, it means that there was less than one pig per kolkhoz family. But even if we reduce Mr. Johnson's figure correspondingly, the fact still remains that even for a small number of animals not enough food can be grown on one-fourth of a hectare, a part of which is used for vegetables, potatoes, and other products for direct human consumption. The feed deficit must be covered by earnings in kind from the kolkhoz farm or by purchases from outside sources.

There are no official data available about average farm income. Estimations are risky. However, if we take this risk and know the possible margin of error, we can at least calculate the approximate dimensions of average farm income. As a basis for further discussion, I have made such a calculation. The details are shown in Table I and Table II, while Table III presents the figures on the kolkhoz population.

I have computed the total annual income from collective work at 2,250 rubles per worker, or 5,000 rubles per household, the latter including 1,650 rubles cash income. The income from the private plot I have calculated as 4,250 rubles per household, half of which may be cash income from marketing and half income in kind for home consumption. This means a total income of 9,250 rubles per household, 3,750 rubles in cash and 5,500 rubles in kind, and a total income per worker of 4,200 rubles—1,700 rubles in cash and 2,500 rubles in kind. If we take as the purchasing power of the ruble, as Mr. Johnson reasonably suggests, the equivalent of 6 to 10 cents in U.S. money in the United States, we have at least a perception of the approximate proportions of average farm income.

Mr. Johnson has indicated the average industrial income as being approximately 750 rubles monthly, i.e., 9,000 rubles yearly. The income of kolkhoz peasants would be nearly half of it. To expect 8,000 rubles' income from a plot of  $\frac{1}{4}$  hectare, as Mr. Johnson does, is certainly too much. Even my calculation of 4,250 rubles is rather optimistic and can only be reached if enough fodder is provided by distribution in kind from the kolkhoz farms. This figure means a labor income of \$400 per

acre, or a level that even by Western standards of efficiency would be quite high. Considering the margin of error, I think that my figures are closer to the upper than to the lower limit.

As these figures show, I am not convinced by Mr. Johnson's statement of near equality of farm and nonfarm incomes and also cannot see, as he does, evidence for it in the increased number of workers in agriculture,

TABLE I. ESTIMATED ANNUAL AVERAGE INCOME OF KOLKHOZ PEASANTS IN THE USSR<sup>1</sup>

Source of income	Per household	Per worker
Rubles		
<b>A. From collective work:</b>		
In cash (250 units, each worth 3 rubles) <sup>2</sup> .....	1,650	750
In kind:		
a. bread grain (250 units, each worth 2 kilos at 2 rubles) <sup>3</sup> .....	2,250	1,000
b. commodities other than bread grain <sup>4</sup> .....	1,100	500
<b>B. From the private plot<sup>5</sup>:</b>		
In cash (from sales in the free market) <sup>6</sup> .....	2,100	950
In kind (products consumed at home).....	2,150	1,000
<b>Kolkhoz peasant income:</b>		
In cash.....	3,750	1,700
In kind.....	5,500	2,500
<b>Total.....</b>	<b>9,250</b>	<b>4,200</b>

<sup>1</sup> Occasional nonagricultural income is of minor importance and is omitted because no data whatsoever are available. Since such data would relate only to a relatively small number of kolkhoz peasants, the data, even if available, would not be suitable for computation of an average.

<sup>2</sup> With a total of 10.5 billion units (42 million workers with 250 units each) this sums up to 31.5 billion rubles distributed in cash by the kolkhoz farms. This figure is in conformity with the figures for total kolkhoz income (63.2 billion rubles in 1954 according to official data), deducting investments, etc.

<sup>3</sup> With 10.5 billion units, this sums up to 21 million tons of grain distributed to kolkhoz members. This is a reasonable figure with regard to the over-all food balance as well as to average per capita consumption (21 million tons for 78 million people means 269 kilos per head), which leaves a small margin for fodder. Any grain distributed in excess of 2 kilos (especially feed grain) will be converted into animal products and will appear as income from the private plot.

<sup>4</sup> Relatively small amount, because only part of it is used for home consumption (vegetables, oilseeds, etc.); the rest is used for feeding animals and shows up as income from the private plot.

<sup>5</sup> The income from the private plot is family income.

<sup>6</sup> Assuming that half of the private-plot production is sold in the free market and the rest is consumed at home.

which has occurred during the last two years and which was obviously caused mainly by other factors. This obvious overestimation of farm income may also partly explain the astonishing fact Mr. Johnson mentions—that he could not detect large differences in the standard of living. Of course, differences in income are not as conspicuous among low-income groups as they are among people with higher income.

TABLE II. ESTIMATED ANNUAL INCOME OF KOLKHOZNIKI FROM THEIR PRIVATE PLOTS

Product	Annual output <sup>1</sup>		Retail price per unit <sup>2</sup>	Value of net output (rubles)	Compulsory delivery			Total income
					Units	Price per unit	Income	
	gross	net				(rubles)		
Milk from one cow (liters).....	1,000	900	2.20	2,000	100	.50	50.00	2,050.00
One pig (kilos).....	120	90	10 <sup>3</sup>	900	30	3.00	90.00	990.00
Eggs from ten laying hens (number).....	600	550	.8	440	50	.3	15.00	455.00
Potatoes, vegetables from .125 ha. (kilos) <sup>4</sup> .....	2,500	2,500	.5	1,250	—	—	—	1,250.00
				Gross income.....				4,745.00
				Cash expenses.....			300.00	
				Average tax in cash.....			200.00	500.00
				Net income.....				4,245.00

<sup>1</sup> Assuming average yields and deducting the separately shown compulsory deliveries.<sup>2</sup> A certain reduction is made for transportation costs, market levies, etc. The kolkhoz peasant can avoid such expenditures by selling his produce to state institutions or consumer cooperatives at above-quota prices which for many products at present come close to free prices. An obtainable price which is lower than the official retail price, but higher than the above-quota price seems realistic.<sup>3</sup> Liveweight.<sup>4</sup> Assuming that not less than half the private plot is used for feed, the rest for potatoes with an average yield of 20,000 kilos per hectare.

Certainly, in the last few years the average income of kolkhoz peasants must have increased as a result of policy changes. The limitations of this possible increase are convincingly demonstrated by Mr. Volin's remark that an increase of purchasing power must go hand in hand with an increased availability of consumer goods. It is difficult to judge whether the present level of average farm income is higher than in precollectivization or prebolshevist times. But even if this could be stated, it would be a wrong assumption to take it as actual proof of the superiority of the kolkhoz system as compared with individual farming. First we must consider that individual peasant farming without the introduction of the kolkhoz system would also have developed to a

TABLE III. ESTIMATED KOLKHOZ POPULATION<sup>1</sup>

Item	Total number	Per household
Estimated number of kolkhoz households.....	19,000,000	
Estimated number of able-bodied kolkhoz workers, including women.....	42,000,000	2.2
Estimated number, kolkhoz population.....	78,000,000	4.1

<sup>1</sup> The 1939 census shows a total population of 170.5 million and a rural population of 114.6 million, the latter including 75.6 million kolkhoz peasants, 3.0 million individual peasants, and 23.4 million workers and employees. At that time there were approximately 18½ million households on kolkhoz farms, around 40 million able-bodied workers including women, or more than 2 per household, and 4.1 persons per household. Considering that the decrease in number of households probably continued during the whole period, but was overcompensated by the number of households in the new territories, we arrive at the figures shown above, if a similar structure of kolkhoz population, with minor amendments, is anticipated.

certain degree. The correct basis for comparison is not the level of 1914 or 1928, but the level that would have been reached if the trend of development apparent in these basic years had continued until now. Second, there are fewer people attached to a certain area than before. If a kolkhoz farm of 1,000 hectares gives only the same yields as formerly occurred on the individual peasant farms on the same area, the average farm income should be greater if there is a smaller farm population attached to it. That for many years, because of abnormal price conditions, the average income of the farm population, despite its decreasing number, was even smaller than before does not matter in this connection. An increase of average farm income caused by a decline in farm population cannot be taken as proof of the superiority of collective farming as compared with individual farming, if it is not accompanied by a corresponding increase of total output.

Mr. Johnson mentioned that all members of the American delegation were surprised at the large amount of labor that was used in conjunction with every farm operation, and that he finds it difficult to imagine what all of these workers do. This revealing remark may seem astonishing if we consider that the proportion of rural poulation out of total population has decreased from 80 to about 60 percent from the precollectivization era to the present, and the percentage of agricultural population even to 50 percent or a little less. In absolute figures the decline was small with respect to rural population, including industrial workers living in rural areas, but there has been a considerable decline with respect to the farm population. Exact figures are not available because no population census has been taken since 1939. Moreover, it is difficult to exclude from calculation the territories acquired after World War II. But the size of farm population attached to a certain area is undoubtedly in all regions smaller now than it was 30 years ago. That the total number of farm workers has again increased in the last two years, as mentioned by Mr. Johnson, does not essentially change the picture that Mr. Volin has shown.

But despite all these changes there are still more people on the land than actually would be needed. If we calculate on the basis of West European norms of labor requirement in farming operations, the normal labor input of the approximately 100,000 large-scale farms composing Soviet agriculture today, with about 1,500 hectares of crop land each, considering their actual present intensity of farming and their actual degree of mechanization, we arrive at an excess farm population of at least 30 million. Yet there is a shortage of labor on many of these Soviet farms, especially of male workers. The reason for this paradox is the unequal geographical distribution of manpower, the low productivity per man, and the low efficiency of an agriculture organized in a bureaucratic way.

Mr. Volin mentioned that Soviet Russia is sometimes held up in the so-called underdeveloped countries of Asia and Africa as the successful model of rapid industrialization by an underdeveloped country. I fully agree with his statement that in this connection the serious disparity between agriculture and industry is of great importance. The belief of some people in underdeveloped countries that collectivization and mechanization of agriculture are prerequisites for rapid industrialization is certainly unfounded. It is an erroneous assumption that only the kolkhoz system, by large-scale farming operations and by the adoption of big machinery, is capable of setting human labor free in large proportions. The American example shows that this object can also be attained without collectivization, and there is no reason to believe that the overpopulated rural districts in Soviet Russia, in their old peasant structure, could not have been able to give up surplus population to an expanding industrialization. Evidently the process of Soviet collectivization, in proportion and pace, was not determined by the simultaneous process of industrialization with its increasing demand for human labor. It is true, however, that only by the kolkhoz system were the Soviets able to establish an extreme disparity between agriculture and industry, and thus to finance industrialization to a great extent at the expense of the agricultural population.

Mr. Volin characterized the present agrarian policy of the Soviets as a combination of coercion and economic incentives. His paper shows the dilemma that faces the Soviets in their present agricultural policy. They want to use material incentives, but cannot risk giving them free play without endangering the whole socioeconomic order established by the introduction of the kolkhoz system. Material incentives in agriculture would become much more effective if the Soviets not only mitigated, but abandoned, the forced disparity between industry and agriculture. Whether this eventually occurs will depend upon the future demands of industrialization and armaments on the Soviet economy.

At the end of his paper, Mr. Johnson mentioned that it is hard to explain why Soviet agriculture works as well as it does. This certainly has to do with the attitude of the kolkhoz peasant toward the kolkhoz system. This attitude is quite an important factor with regard to production and productivity of agriculture in Soviet Russia. No doubt in the initial stage the kolkhoz system was disliked by a great number of peasants. A clear proof of it was the attitude of kolkhoz peasants in 1941 during the first months of German occupation. In remote villages where, after the retreat of the Soviet army, the peasants were not disturbed by orders of the German authorities and felt free to act according to their own wishes, in all cases they dissolved the kolkhoz farms at once and turned to individual farming. The young kolkhoz members were no exception. How-

ever, many years have passed since then. At present, all kolkhoz members under 40 years of age, i.e., the majority of them, have not themselves experienced the status of independent peasants. Certainly the absence of any alternative as well as custom are powerful factors favoring the kolkhoz system and the Soviet system in general. It may well be that anti-kolkhoz feelings, which certainly still exist, are gradually diminishing. The trend of development seems to be that kolkhoz farms are gradually coming closer to sovkhoz farms. Finally, the kolkhoz peasant may become a common farm laborer and may cease to have the hidden desire to be an independent peasant, as usually it is not the desire of an industrial worker to be an independent craftsman. The report of Mr. Johnson and other reports of recent foreign visitors to Soviet Russia seem to indicate that, compared with prewar times, a certain stabilization in the kolkhoz system has been reached.

## TARIFF POLICY FOR THE U.S.A., A STRONG, RICH COUNTRY\*

Chairman: Charles P. Kindleberger, Massachusetts  
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### INTRODUCTION: TARIFF POLICY FOR THE U.S.A.

CHARLES P. KINDLEBERGER

**T**HIS evening's session, devoted to that hardy perennial, the tariff question, is to be organized somewhat differently from the usual meetings of the American Economic Association, and, I assume, from those of the American Farm Economic Association. The session begins with an introductory statement of 15 minutes by the chairman, on which I am now launched, before the introduction of a panel of five speakers interested in a variety of different aspects of the subject. After these gentlemen have severally and collectively explored the area, the program calls for a summary by the chairman to introduce a general discussion from the floor.

President Black has taken strenuous measures to ensure that our discussion should be lively. In the first place are the arrangements to fore-stall long papers. Second is the jointness of the session, which requires the trade economists among us to take into account the agricultural aspects of the problem, which we frequently slight. Third is the strongly emotive title, with its suggestion that there are different answers to the tariff question, depending upon whether a country is strong and rich, or weak and poor.

When I called the tariff question a hardy perennial, I did not mean to suggest that we have long understood all about it, and that familiarity has bred contempt. On the contrary, I believe that our insight into the forces at work has increased enormously in the last economic generation. The tariff used to be regarded as a question of resource allocation. It may so be today in weak, poor countries. But for us in the United States, it seems clear that the tariff is primarily a concern of income distribution. With supply fairly inelastic in the intermediate run, the infra-marginal effects are more important than change at the margin. The general interest in resource allocation and material output is well-nigh lost to sight in the conflict of sectors and factors in income distribution.

With this emphasis, and the help of the Stolper-Samuelson theorem, one can sum up the U.S. tariff history in a paragraph—provided that one

\* Joint session of the American Farm Economic Association and the American Economic Association.

studiously ignores Leontief's findings on United States comparative advantage and disadvantage. In the beginning, the United States was land abundant, but the scarce factor, capital, was politically ascendent. This accounts for a high-tariff policy. The change to freer trade in the 1930s did not occur because of a shift in political power, such as took place between the landed gentry and the rising industrial class in Britain, and led to the repeal of the Corn Laws. In this country, a change occurred in factor proportions, and with it in comparative advantage. Capital accumulation and mass production, after World War I, combined to give the United States an advantage in capital-intensive products and a disadvantage in labor-intensive products, with the intermediate position previously occupied by labor turned over to land. Innovation in agriculture in World War II, moreover, has made large branches of that sector capital intensive. These changes explain, not without some difficulties, the changes in trade policy, since capital, continuously dominant politically, with the help of labor in the mass-production industries, finds its bread buttered on the low-tariff, rather than the high-tariff side. It is easy, in this light, to understand the resentment of the pro-tariff forces that they are characterized as selfish interests while the proponents of tariff reduction claim to speak in the national and even in the cosmopolitan interest.

The inconsistencies in this one paragraph may require a few more words of explanation. Why were not the Middle West and Great Plains farmers as free trade as the Cotton South? The answer is Canada with its large supplies of farm products lying over their shoulder to the north. How does one account for the Smoot-Hawley Tariff Act of 1930, in the light of the change of comparative advantage in the First World War? The answer suggests the log-rolling character of the Senate, and cultural lag. Why the leadership of the border states and the South in the movement toward freer trade? It is cultural lag again, but one that is narrowing as Senator George of Georgia requires assurance on protection for textiles before he will vote for H.R. 1 of the 84th Congress. Why do cotton (and wheat) farmers no longer push U.S. tariff reduction? Price supports on the one hand, which convert the export problem into one of surplus disposal, and probably the view that the reciprocal demand curve facing the United States is inelastic for farm products. More dollars abroad from more United States imports will undoubtedly mean more exports of machine tools, tractors, farm machinery, and automobiles, but probably little more of the farm products now in world surplus.

Although economists almost unanimously accept the income-distribution explanation of tariff changes, too little work has been done on the conflicts within sectors, and even within industries, for industrial organi-

zation and international-trade theory. Noncompeting groups are more prevalent than trade theory allows when the ancient CIO was for tariff reductions, the AF of L against; when the CED representing newer industries is for freer trade, but the NAM made up of new and old is unable to take a stand; and when large and small oil companies are pro- and anti-imports respectively, but manage to suppress their disagreement in the useful but meaningless slogan of "Imports to Supplement but not Supplant Domestic Production."

One further point may be worth watching for international-trade theory. Professor Taussig dealt with an abstract universe in which there was "a given state of the arts," and so do Stolper and Samuelson. In a Schumpeterian world, however, with time required for the diffusion of technological competence, comparative advantage may exist briefly, based on innovation, and in the face of a long-run unfavorable situation in terms of factor endowments. The United States with a comparative disadvantage in them may nonetheless export new labor-intensive products while other countries are learning how to make them. When the technological gap is closed, the basis for trade reverts. This explains why manufacturers of radios and heavy electrical equipment, long among the exporters, are today seeking protection through tariffs, and Buy-American preference.

Is it appropriate that political forces fighting over the distribution of income should determine the tariff policy of a strong rich country? Before we can answer that, we must consider in which direction the net weight of these forces is now pressing, and what tariff policy should be on other grounds. And in this latter connection, we are particularly obliged, in the light of the current debate, to consider the distribution of income among countries, the relation of tariff policy to equilibrium in international payments, and finally the recent course of U.S. liberalization with its expansion of the escape clause and the defense argument.

Should a strong, rich country insist on reciprocal reduction of tariff barriers abroad? In the period 1828 to 1914 Britain did not; since 1934, the United States has done. Some claim that our tariff reductions have in fact been unilateral, since concessions made on United States exports have been held in abeyance by quota restrictions or foreign exchange controls; there is some substance to this view. This may be all right on either of two counts. To the extent that tariffs improve the terms of trade, and one's international social welfare function favors transfers of income from strong, rich to poor, weak countries, American free trade and foreign protection increase world welfare. I am dubious of this justification, however, on the ground that tariffs imposed abroad are unlikely to alter U.S. terms of trade much, if any, in the relevant period. More significant is the view that it makes little difference to the United States as a whole,

and probably little difference by sectors, how high the rate of protection is abroad. With appropriate qualification for the recent build-up of reserves and a certain movement of capital here for safekeeping, foreign countries spend all the dollars they earn through exports. An increase in U.S. imports produces an increase in exports, along the lines of the classic price-specie flow mechanism. But an increase in U.S. exports does not as surely or quickly bring about expansion in imports. This strong, rich country can afford to undertake unilateral reduction, since it does not cost anything.

This asymmetry in response also throws light on the relation between our tariff policy and the persistent disequilibrium in dollar payments. By and large, the tariff has nothing to do with the disequilibrium, and "Trade not Aid" is primarily a slogan to saddle the strong, rich country with responsibility for the troubles of others—an allocation of blame which, however appropriate to the 1930s, is out of place now.

If tariff reduction is required neither by international redistribution of income nor by the restoration of equilibrium, why should one favor the selfish interests that would like to increase their income through additional exports over those in existing import-competing lines? The answer, I think, is found in the instinct of most economists. Use the price system to allocate resources, and other devices if need be to redistribute income. There will be times when a country must redistribute income with the tariff, if its direct tax system is rudimentary. And it is further true that the recipients of income benefits strongly favor that these take price form, rather than subsidies—*vide* the success of farm price supports over the Brannan plan. Yet subsidies and taxes are preferable to tariffs, whether for the infant-industry argument or national defense, and not for the reason that subsidies tend to drop out after the need for them has disappeared—*vide* soil conservation payments. The total income of the United States in real terms can be expanded by freer trade, and this is justification enough.

What sort of a tariff policy does the United States have? The answer is a timid one, inappropriate to a strong, rich country. We have made much progress since 1934, but at the moment the pace has slowed down to a walk. It is really difficult to see why a number of industries are so disturbed by the present program. It would seem easier for a strong, rich man to get to heaven, or a camel to get through the eye of a needle, than for an item under existing schedules to be reduced 15 percent between now and 1958, and have that reduction stick in the face of defense and escape-clause procedures. Several economists led by Klaus Knorr and Gardner Patterson have given their view on the size of the prospective reduction in tariffs a year and a half ago, and I see no reason to

modify their conclusion that our policy in this respect is unduly pusillanimous.

The year 1955 produced a setback for lower tariffs in the broadening of the escape clause. The escape clause requires more study—not by candidates for the doctorate in economics, who will in fact provide it, but by moralists and political philosophers. A small compromise on a matter of principle, taken in connection with the Department of State's negotiations with a single country, provided a focal point of attack by the opponents of the principle, who have chivvied and worked at the weak spot until they can now drive a coach and four through it. Intellectually dishonest in origin, like the advertising of a painless dentist, the escape clause has been used thus far very sparingly and even then not always to accomplish the purposes intended. Take the outstanding of the three uses in the Truman Administration. This was in 1950 at the time of the close election contest involving Senator Benton in Connecticut, where felt hat bodies were found to be suffering serious injury or the threat of injury. The Department of State contends that the President's action at this time was not political but was a defensive step. The opposition would be unwilling to rely on the assurance of the escape clause, if it were never invoked.

History repeats itself. In 1954, it was expected that Senator Saltonstall would have a close race against Mr. Foster Furcolo—and the escape clause was invoked against Swiss watches to help him; or possibly, as the other explanation runs, to demonstrate to a skeptical Congress that this Administration would use the clause. In any event, the price was high. Europeans lost confidence in the continuity of our tariff policy; and the Administration was convicted of further intellectual dishonesty through citing the interests of national defense in the face of a Defense Department memorandum, later disclosed, which said that these considerations were irrelevant. Moreover, for its high payment it got nothing, whether Saltonstall's election which was handily won (as contrasted with Benton's close squeak), or the limp integrity of the existing escape clause. The clause was subsequently compromised in a variety of ways in order to get H.R. 1 on the statute books, and we may confidently if sadly expect to have the recent bicycle decision followed by more, unless the Administration repudiates its promises to the Congress, or unless foreign exporters, as in Japan, restrict exports to a level just below that at which this country would act.

The other basis for misgiving is the promise of readier invocation of the defense argument and defense powers to limit imports, especially of oil. It is hard to restrain one's cynicism in this matter. For a long time, the Texas Railroad Commission examined production plans in the light of

conservation, the exigencies of which presumably changed monthly. Today, when the political allegiance of that state is in some doubt, the federal government finds it necessary to examine frequently into imports of oil with a view to ensuring the national defense. How sanctimonious can we become in our governmental price fixing?

I do not know the size of the smoked-fish industry which had recently been charged with violation of antitrust laws, but I confess to some wry amusement when I consider this act of virtue, widely acclaimed by the conservative press, in the context of the government's action in requiring the oil industry to conspire to limit imports of petroleum. If the oil producers are to join the farmers in getting price supports—more readily effected in an import-competing industry than in an exporting sector—it is time they acknowledge it openly. But I suspect they believe, as I do, that if they were to disclose their real motives, they would not get the price increase. At the very least, they are guilty of obtaining income under false pretenses.

The allusion I have just made to the difficulties of price support in an exporting industry brings up the success the United States has just achieved last summer in getting permission from GATT to impose quotas on agricultural products subject to price supports. This notable victory for the country urging other countries to give up quotas is of course required particularly by the lower farm prices in Canada.

This raises a question I should like to put to the "farm" members of the panel. What is there about agriculture that makes it so frequently subversive of the movement toward freer trade? As Mr. Fitzgerald and Mr. Bissell know from their ECA experience, the German farmer is the barrier to further liberalization of quotas in that country; the Belgium farmer is the block on which the Belgian-Netherlands-Luxemburg economic union has stumbled; and the economic sins of the French peasant are too numerous to be listed. Even such a convinced libertarian as Roepke believes that agricultural markets should be rigged to maintain the European peasant and the virtues he embodies. And Polanyi in *The Great Transformation* suggests that only the British could bring themselves to liquidate their agriculture because the doctrine of free trade requires it, and that nowhere else would economic values so completely triumph over social.

Here between Canada and the United States, however, it is not so clear that the broad social and the economic forces are ranged on opposite sides. There are some other forces lined up against heightened economic and social integration between our two countries—the fish and mineral industries in the United States, some considerable branches of manufacturing in Canada, and nationalistic forces on both sides of the border,

but the farm obstacle seems to be the biggest of them all. To what is it due? Is the American farmer much less efficient than the Canadian, or does he merely require a much higher standard of living and has he been able to organize politically to obtain it?

I hope that the foregoing disjointed remarks are a sufficient introduction to our topic. My view in summary is that we don't have the tariff policy appropriate to a strong, rich country; that we could undertake unilateral reduction; that we should use peak periods of prosperity such as 1955 to do it; that we should do it in amounts greater than 5 percent a year, especially in industries where the *ad valorem* rate is currently more than 50 percent; and that we should shift resources out of lines where they earn less than an average return, unless overwhelming grounds of national defense, the promise of decreasing costs, or some peculiar social attachment makes moves practically impossible. In these cases I am for subsidies. A strong, rich country can afford them if it wants to.

## THE ESCAPE CLAUSE

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I THINK we may say that conflicts in American tariff policy are not primarily a struggle between capital and labor. The over-all pattern of our foreign trade cannot be explained by a two-factor model. The influence of our greater capital stock on the factor distribution of income may be overshadowed by two other factors, namely, technique and natural resources. We export manufactured goods in exchange for imports of primary products. And since our primary production is capital-intensive compared with our own manufacturing, the economic basis for America's swing toward freer trade appears to rest more on technical superiority than on capital stock. The source of modern protectionism, on the other hand, stems from a relative deficiency of certain natural resources as well as from a number of small industries that lack sufficient technical superiority to live without protection.<sup>1</sup>

The main problem, as I see it, is to get resources actually shifted out of import-competing industries into more productive employment. Once completed, the effect of this adjustment on factor distribution of income is probably overshadowed by other influences because, in aggregate terms, the displacement resulting from lower trade barriers is a minor one compared with the adjustments associated with growth. The policy question is "what *rate* of adjustment?" and the acute problem arises chiefly in agriculture and in those protected industries where employment is already declining or increasing less rapidly than population.

Support for freer trade is stronger today than ever before. But few of those who have testified were prepared to stand up and be counted in favor of eliminating any branch of home industry. Thus, our policy is compromised by the express threat that protection will be increased if lower duties succeed in their ostensible purpose of liquidating protected industries. Although the escape clause has been invoked sparingly, foreign suppliers and importers are deterred from risking the substantial costs of developing an American market by the threat that their business may be destroyed if they are successful.

It is a poor policy to lower tariffs and threaten home industry, only to raise them again and displace imports. It would be better to limit the growth of imports in the first place to a rate that can be accommodated

<sup>1</sup> These issues are stated a little more fully in my paper, "A Tariff Policy for the United States," delivered at the Southern Economic Association, November 11, 1955; see also, my testimony, Hearings, Joint Committee on the Economic Report on *Foreign Economic Policy*, 84th Cong., 1st sess., pp. 267-272.

by the shift of resources. We already attempt to do this by reducing tariffs gradually. But this is not enough. Some protected industries are already contracting employment owing to structural changes associated with changes in technology, taste and income. Moreover, imports may not respond to lower duties for a decade and then increase quite rapidly, owing to changes in costs, aggressive sales effort or adjustment of exchange rates. Rapidly growing industries can absorb a rate of increase in imports that would cause acute distress in declining and relatively stagnant industries. Moreover, I believe that most of our mass production industries can adjust to foreign competition by changes in the composition of output. Our policy is inadequate in that the criteria of serious injury are ambiguous, inequitable and deal mainly with product competition.

Tariff adjustment is concerned with the use of resources. Thus, the problem of serious injury should be viewed mainly in terms of factor markets rather than product markets. This calls for modification of policy that can be summarized in four points.

1. Eliminate protection gradually for those growing industries that can absorb foreign competition without the need for contracting domestic employment.
2. Apply the test of injury to industries rather than to products or small segments of an industry. It is inequitable, as well as wasteful, to provide protection on a product basis to healthy, growing industries when the same resources could otherwise be used to produce goods and services of greater value. Moreover, it will often be found that, by changes in composition of output, the adjustment can take place within the industry itself.
3. In those home industries where employment is already contracting, the growth of imports may be limited, so far as practicable, to a rate that can be accommodated by the shift of employment. This means that the criteria of tariff adjustment should include the effect of all the forces in a dynamic economy and not the effect of imports alone. A change of national policy should avoid creating greater disparities in income than are needed to redirect resources into more productive employment.
4. If an industry is seriously threatened, for any reason, the escape clause may be used as a reprieve to provide time enough for adjustment, rather than as holding the promise of permanent protection. As the reprieve expires, protection would automatically decline. I assume that protected industries have a claim to sufficient time to adjust, primarily by attrition of labor force and depletion of fixed investment.

The constant threat that the escape clause may be invoked is a menace to trade. At the same time, a few minor industries were denied relief under the escape clause, although, in my opinion, they were seriously injured in the sense that they did not have time enough to adjust to both foreign competition and other dislocations. Thus, my criticism extends also to the administration of the escape clause. Both domestic producers and foreign suppliers are entitled to a clearer idea of what to expect than is possible under the present system.

Members of the Tariff Commission have differed too often along party lines, and the President has rejected too often the Commission's recommendations on grounds that contravene the intention of the Congress. Although the President's motives were good, I am afraid that the result has been bad government. In declining to invoke the escape clause, as recommended by the Tariff Commission, the President has presumed responsibility for bringing into account the following considerations in addition to statutory tests of serious injury: (1) the effect on American export markets, (2) protection of American consumers, (3) implications with respect to foreign policy, and (4) the question of compensating tariff reductions to those nations whose exports would suffer if the escape clause were invoked.

These are clearly considerations of the highest importance. They call for a liberal policy including modification of the escape clause. But, they are, I submit, immaterial to the question of whether or not a specific import-competing industry is seriously injured. Virtual injury to exporters and consumers is implicit in the Congressional mandate to avoid serious injury to domestic import-competing products. And since the President's tariff making powers are delegated powers. I believe that the intention of the Congress should be carried out even though its policy may be misguided.

The intrusion of foreign policy into the determination of serious injury is inequitable because in a market economy there is no way of harnessing private trade *ad hoc* to the dictates of the national interest. In the case of scarves, for example, President Eisenhower's statement almost implies that more substantial proof of injury is required because the imports were from Japan, and because of our special interest in the expansion of Japanese trade. It would seem to me that criteria of tariff adjustment should be applied systematically and uniformly and that if any industry is singled out to bear a special burden because of considerations of foreign policy, it has some claim to compensation.

This brings our remarks into focus on the title of tonight's discussion—"tariff policy for a strong, rich nation." It is one thing to pursue a liberal policy for classical reasons, but it is rather a different matter to call

for liquidation of certain domestic industries for political reasons or because of the unequal distribution of world income among nations. Everyone in a rich country is not rich, and everyone in a poor country is not poor. The fact that America is a rich nation does not resolve the difficult problems of equity that are involved in a change of policy which would condone serious injury for the sake of national objectives. Some form of financial assistance to facilitate re-employment, migration and developments of new industries would be entirely appropriate. But, in any event, it would be better to regulate the rate of increase in imports than to encourage trade and, at the same time, threaten to restrict it.

In sum, I have advocated that the policy of gradual adjustment be made effective in this dynamic economy (1) by requiring growing industries and Big Business to absorb little injuries, and (2) by providing declining industries with a reprieve from foreign competition where necessary to give them time enough to adjust without unnecessary loss and hardship.

## ROLE OF AGRICULTURE IN A MODERN U.S. TARIFF POLICY\*

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EARLY in his excellent paper Professor Kindleberger suggested an analogy between tariffs and farm price supports. Later he suggested that in the United States tariffs primarily were a tool for income redistribution. This may well be true, but agriculture by and large has discovered that the tariff is not a powerful tool for income redistribution when most farm products are exported. Price supports and other measures appear to offer greater opportunities.

Before developing these ideas it may be appropriate to make three brief descriptive points about agricultural tariffs. First, most agricultural tariffs are specific, i.e., are in dollars and cents rather than percentages of value. Hence the inflation since the thirties has reduced the effective tariff rate substantially. Second, the classification of agricultural commodities is more clear cut than industrial classifications. It is difficult for an industry representative or customs official to argue that an agricultural import is really a different commodity and hence subject to higher tariffs. The invisible tariff is less important for farm products. In fairness these two points should be set against the third, namely that during the past two decades quantitative controls have become a part of the U.S. trade policy largely through agricultural commodities. Although agricultural tariffs have been reduced by trade agreements, quotas and embargoes have been erected against wheat, cotton, sugar, butter, cheese, other dairy products, other fats and oils and against certain feed grains.

Nearly all of these, however, came about as an appendage of price supports, to which we now turn. This will become clearer by tracing through a hypothetical example. Assume that Congress declares cabbage a basic crop with price supports at 85 or 90 percent of parity. By removing much price uncertainty and guaranteeing farmers against serious losses, farmers are encouraged to shift to cabbage and away from more uncertain crops. Furthermore, they are now willing to make longer term commitments and to apply on their limited acreage, production innovations that had been hesitatingly considered previously. With production increases the government stocks of cabbage build up, despite population increases. To hold cabbage in storage some of it is converted into sauerkraut. (Consider the smell this would create.) Higher prices attract cabbage from Canada, Mexico, and Great Britain and kraut from Germany

\* Journal Article 1863, Michigan Agricultural Experiment Station.

and the Netherlands—imports where none or almost none had previously existed.

Few political leaders and few citizens are prepared to extend the cabbage support program around the world either for income or for resource objectives, particularly if they have some doubts about its economic feasibility and political necessity within the U.S. Quotas or embargoes then do not raise serious domestic questions even if it means that a few heads of cabbage are barred from entering. Next, the officials in charge of the cabbage-kraut program try to find some way to reduce the stockpile. The prisons, orphanages and school lunch program can absorb a certain amount, but export sales become the magic by which officials hope the stockpile will disappear. Inquiry determines that a subsidy is necessary if they are to compete with local cabbage growers in Europe. The ambassadors and the State Department object to this as conflicting with trade policy and the attitudes of farmers overseas; so the agricultural attachés are shifted under the direct control of the Secretary of Agriculture. Here they have a freer hand in merchandising the agricultural surpluses, in utilizing the full array of quantity discounts, in meeting competition and in price cutting as developed in modern industrial pricing. Cabbages are treated as kings, but sold for the poorest local currencies.

To complete the somewhat exaggerated picture represented by this pattern the true protectionism involved in sugar and wool must be added, with dairy products in between. Even here, additional domestic programs have been added to attain price and income objectives not feasible through tariff adjustments, either because the resulting price would encourage greater use of synthetics or because of direct conflict with trade agreements. In the main, however, recent trade limitations in agriculture are a consequence of the particular techniques being used in domestic agricultural programs. Such conflicts of agricultural and trade policy will continue unless and until new techniques are accepted to attain possibly revised agricultural policy goals. Moreover, the issues and decisions likely will be made primarily in terms of the domestic environment, and not because of trade and international conflicts.

Why have these problems arisen? Why is American agriculture unable to sell much of its wheat, cotton and other products except at special prices? Is the price level too high to permit agriculture to compete? The answers to these questions appear to center around the growth and changing structure of the American and world economy and the beliefs, values and goals of our society with reference to agriculture.

Professor Kindleberger has already mentioned the Stolper-Samuelson theorem and changes in the land-labor-capital ratios. This suggests that

the United States is losing much of its comparative advantage in agriculture, and this despite the more rapid increase in productivity per man-hour in agriculture than in industry since 1940. However, there appear to be more than productivity ratios involved. Other nations are applying many of the technical and scientific innovations of our experiment stations and laboratories. In fact, the United States has assisted actively in the export of these processes both to Europe and to underdeveloped areas. It costs less than formerly for Europe to increase its self-sufficiency. Thus we are losing the early start we had in lifting agricultural productivity. Possibly as important is the continuance of institutions developed in Europe for stretching supplies and resources during periods of war and dollar shortages, and the fixed capital and technological investments made in expanding export crop production in agricultural export countries, while price support umbrellas reduced price uncertainty to an important degree. Both of these processes, one politico-administrative and the other economic, are difficult to reverse. To these factors must be added a shift in the reciprocal demand, possibly due to economic growth and low income elasticities for food, such that dollar supplies tend to be used more fully for industrial products than for food. All of these appear to be adverse to agricultural foreign trade and add to the readjustments forced upon agriculture by its expanding productivity within the domestic scene.

Domestic price supports have not been appropriate measures to stimulate desirable shifts for a relatively declining industry. Detailed examination of this problem brings up the question of noncompeting groups to which Prof. Kindleberger also referred. A development of this idea also would help answer the question about why European farmers were barriers to trade liberalization. To shift from farming and rural community to an urban occupation involves monetary costs and changes in the social-psychological reference pattern, which appear to involve greater resistances than do shifts from a trade to a craft union, or from an older to a newer industry. Even in a society as fluid as the United States and with wide communication and flexibility, the migration from agriculture has not occurred at the rate and from the areas in sufficient quantity to equalize income and resource returns. Bearing in mind the higher rural birth rates and the greater social rigidities it should be expected that rural groups overseas would resist measures that can do nothing but reduce their income and the farming prospects for their children.

This brings us to the heart of the problem. As suggested, agricultural import and export policies are an adjunct to domestic farm policies. Programs to expedite such policies are formed in the political process,

which strives to soften the adjustments for a declining industry with important noncompeting groups. If revisions are to occur that will encourage needed adjustments, two major strands of beliefs, values and goals will need to be disentangled. Their continued confusion explains some of the support that agricultural senators and agricultural committee chairman are able to obtain in the more broadly representative House of Representatives.

One of these strands or beliefs is that it is unfair that farm income and farm people should be whipped about by the fluctuations of the business cycle and inelasticities of demand. Although this argument may appear to have little relevance today it was important in inaugurating the programs. Moreover, farm leaders are not convinced that we are operating on a new permanently high plateau of business activity.

The second ethical value-belief strand is that society should take steps to prevent low incomes both in agriculture and elsewhere so that all can enjoy at least some of the fruits of the fantastically rising level of living in these United States. The usually quoted statistics, which include important noncompeting groups, part-time farmers, retired farmers, etc., help to maintain the idea of "a farm problem" rather than a series of "farm problems." Price supports at 200 percent of parity contribute little to improving the situation of small farmers with little production. But until these two ideas are dissociated and the nature of income distributions in agriculture become clearer to the general citizenry, it will be difficult to introduce major changes in farm programs. Thus the inconsistencies in trade and agricultural programs may be expected to continue, and probably intensify as technological programs in agriculture take a firmer hold in other parts of the world. This will increase the pressure on farm imports and work against farm exports, unless we can find some way to have these exports play a really strategic role in economic growth and development abroad.

## TARIFF POLICY—HARDSHIP CASES AND RECIPROCAL BENEFITS

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*Washington, D.C.*

THE subject of this evening's discussion presents a choice. One alternative is to take it seriously and discuss the ideal tariff policy that would be appropriate for a strong rich country. But the gap in this field between the most that is politically feasible and the least that could be described as economically desirable is so wide that the ideal is unrealistic and visionary. I share the Chairman's view that we could and should undertake unilateral tariff reductions especially in a period of high prosperity, that the way to deal with hardships caused by this type of economic adjustment (as with those resulting from other types of adjustment and adaptation) is to give direct help to the injured but certainly not to discourage change by protecting their positions in the economy indefinitely, and that the defense argument for tariffs is palpable and self-righteous nonsense in nine cases out of ten. Rather than defend this position, however, or examine what would be an ideal tariff policy, I will adopt the other alternative and focus on certain immediate steps that might be taken within the limits of what is or may be politically possible toward an unhappily remote goal.

Obviously the minimum immediate objective must be to keep moving, at least slowly, in the right direction and to forestall extensive backsliding through the escape clause procedures. It is difficult to exaggerate the importance of the predictability of our trade policy and of security of access, even if on insufficiently favorable terms, to the American market. In order to realize any of the benefits that would flow from a more liberal trade policy, the foreign producer must be reasonably confident that the terms on which he can do business in the American market will not be modified to his disadvantage as a result either of the general pressure associated with the reappearance of buyers' markets in many lines or of new restrictions imposed on the particular product he sells in direct response to his own success.

To give him the assurance poses a problem in political economy, with a greater content of politics than economics. As a political matter the ultimate fate of American tariff policy will be determined largely by two sets of groups: those who are hurt by lower tariffs and those who are benefited. Leaving aside the Chairman's subtler historical explanations, it is undeniable that a very few really determined political enemies can halt progress toward lower tariffs and that alleged generalized benefits to the consumer rally precious little political support. Accordingly, it

might be the better part of valor on the part of the advocates of tariff reform to take the lead in developing a sensible procedure for dealing with those who are really hurt by foreign competition and at the same time to give thought to means of identifying and dramatizing benefits that can be obtained for producer groups through tariff reductions and tariff negotiations.

The existing broadened peril point provision is one device for dealing with actual or prospective hardship cases. The law specifies only vaguely what standards are to be employed in determining hardship. It is quite specific in providing that actual or prospective hardship when identified is to be relieved through the grant of increased tariff protection. Within the limits of what is politically possible, there is no prospect of doing away entirely with any kind of provision for hardship cases. But much could be accomplished (a) by devising standards of hardship that are sufficiently precise to minimize uncertainty and sufficiently appealing on the grounds of equity to resist political attack, and (b) by adopting measures to deal with hardship that will have the least disruptive effect on our stated tariff policy.

As to the standards to be applied, it is important to begin with the principle that tariff reductions should neither be precluded nor withdrawn on the basis of the single test of "caused or threatened serious injury" to particular private interests, as provided by existing legislation. It should be the declared duty of the executive branch to make a judgment in the national interest, even when it is acting within the procedure designed to give due recognition to private group interests and to minimize the injury to particular groups that will sometimes be unavoidable.

Another principle that should be clearly established in assessing the degree of threatened or actual damage is that, insofar as tariff protection is accorded to domestic producers, it is designed to protect only an established volume of business in the sale of already existing products and that there is not even a *prima facie* case of injury unless a domestic industry faces an absolute shrinkage in its sales. Protected producers should not be allowed to claim a vested interest in the growth of the American market, or in a market for something that is not yet in production or at least in process of development.

A third rule that might well be formalized is that injury can be demonstrated only on the basis of actual experience over an appreciable period of time. One of the purposes of this limitation is to prevent the use of a procedure, which is designed to identify particular hardship cases, to cause in effect a reversal of general tariff policy whenever there is a general decline in production in the United States.

A fourth desirable rule, which is already established in Tariff Com-

mission cases, is that injury can be ascribed to foreign competition only if the products imported from abroad are closely similar to the established line of the domestic producers' concern.

Once measures for dealing with hardship cases are established, a higher tariff rate obviously is not the only possible remedy that could be devised. In the first place, even if the remedy is to be sought by way of renewed protection against imports there may be ways of furnishing such protection that are less damaging to the foreign producer and the threat of which, therefore, does less to render the American market insecure. In the second place, it is by no means clear that protection against imports is the best way either to prevent or to compensate for injury; or to give relief to a company, a group of workers, or a community that has been injured by foreign competition; or to facilitate readaptations and shifts of resources, which is the only effective response to competition from abroad.

Even if we assume that renewed or increased protection is to be the remedy where foreign competition has done serious damage, the great objection to raising the tariff is that it impairs the competitive position of the foreign producer and limits his invasion of the American market in a manner rendering that part of his American market that he is able to retain less profitable than he had expected it to be. Thus the foreign businessman who has undertaken substantial investment in the American market, or with an eye to it, is exposed to the risk that the market may be rendered unprofitable overnight and his capital destroyed by a political decision uncontrollable and unpredictable by him.

Consideration should be given to means of providing protection to domestic producers in such situations and to still allow the foreign businessman to retain on a profitable basis at least a major part of the business he has built up. A device that might accomplish this result is a tariff quota, that is a quota to which the reduced rate of tariff would prevail but beyond which a higher, more protective rate would be applied.

Remedies other than renewed protection can be based on a good argument that open, direct compensation to the injured parties would be far cheaper to the nation than the concealed subsidy involved in a tariff. A more profitable line to pursue than compensation for injury is that of a federal contribution toward the cost of adjustment. The adjustment benefits available to business enterprises might include the privilege of quick amortization of new facilities, the right to an exceptionally liberal carry-forward or carry-back of losses for tax purposes, and access to loans to finance adjustment costs where impaired credit or shortage of capital is a limiting factor. Another type of benefit might be offered to communities hard hit by international competition. The

federal government in dealing with such situations, should in the first instance require the submission of some plan of campaign developed on local initiative (because without local initiative no such effort will be successful anyway) and might offer to share with states and localities the costs of new basic facilities, retaining programs, and other costs of attracting new industry into the community. An effective depressed-areas policy would presumably include such arrangements and would render unnecessary federal assistance tied specifically to tariff-caused economic adjustments.

Vastly more could be said on how to deal with the communities and the private interests that suffer from tariff reductions; but I wish to comment very briefly on the means of identifying the benefits of tariff reduction to producer groups and thus mobilizing some affirmative political support for trade liberalization. Granted that the real gain to be achieved by reducing tariffs is a more efficient use of American resources and (as I would contend in opposition to the Chairman) some contribution toward stable international monetary equilibrium, the orthodox liberal case is one that never has had and probably never will have much political sex appeal in the United States. Accordingly, it is highly desirable to retain at least the basic principle of the reciprocal trade act that U.S. tariff reductions should be offered in return for reciprocal "benefits," that is, for concessions that will be recognized by producer groups in the United States as tangible benefits to them. It is equally clear that the benefits sought by the United States should not be limited to reciprocal tariff reductions. They might well include a variety of actions that are of more direct value to the United States and that are more likely to contribute to a state of economic balance in the free world. For example, other nations might undertake to give American (or other foreign) capital full equality of treatment with domestic capital in order to create an environment more favorable to an outflow of private capital from the United States. Also, other countries might agree to allow imports of an agreed list of American products, especially agricultural products, to expand as the U.S. increased its imports from them of goods benefiting from tariff concessions. And then there is always the possibility of exchanging freer access to the U.S. market for the undertaking to maintain certain restrictions on trade with the Soviet bloc.

It is at least possible that, in order to obtain reciprocal benefits of greater domestic political value, the U.S. should abandon the most favored nations policy (at least in its present form). Obviously, the bargaining power of American negotiators in tariff reductions, and their ability to obtain reciprocal benefits having some political sex appeal, is greatly impaired if they are bound by the most favored nations prin-

ciple. To indulge in bilateralism and to create a state of affairs in which there was a different schedule of tariffs for each important trading country would of course be an unthinkable step backward. But it would be possible to have one schedule of tariffs and other import regulations applicable to all countries that have entered into trade agreements with the United States and another, presumably less favorable, applicable to nations that had not done so. It should be clear, however, that the case for such an arrangement is political rather than substantive. The United States probably has too much bargaining power already in relation to its allies and the friendly neutrals. But one does not have to be an economic determinist to believe that the very possibility of sustaining an enlightened U.S. commercial policy may depend upon developing within the United States a much livelier appreciation by powerful pressure groups of the benefits they obtained from international trade

## TARIFF POLICY FOR THE U.S.A., A STRONG, RICH COUNTRY

DENNIS A. FITZGERALD  
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MY CONTRIBUTION, if any, to this evening's discussion makes no pretense of being erudite. Perhaps I should confess at once that I haven't even read Stolper, Samuelson and Leontief on the subject of tariffs.

As an economist (Taussig era), my predilections are all in favor of free, or at least freer, international trade. I believe this is the only course that the United States at this moment of history and in response to its position of world leadership can follow. Granted, progress is by no means uninterrupted. We frequently appear to slip back more than we move forward, like the small boy who was late for school one rainy spring day (this, of course, was before the age of consolidated schools and school buses). His excuse to the teacher was that he slipped back two steps for every step he took forward. "How then," demanded the teacher, "did you ever get to school?" "Oh," said the boy, "I just turned around and pretended I was going home."

Most foreign exporters and government officials do not take any serious exception to our stated tariff policy. What concerns them is the way we carry it out. The difference, they complain, exists between policy and practice, although there is scarcely a complainant who has not perpetrated some major atrocities in his own right. Let us review briefly a few of the more important components of the total.

### *Level of Tariffs*

The United States is now apparently a country with moderate tariffs. These are not as low as such traditionally low-tariff countries as Scandinavia, Belgium and the Netherlands; not as high as France, India, Canada and most underdeveloped countries.

I say "apparently" advisedly because accurate statistical comparisons are difficult to make. The average duty paid on dutiable imports into the United States is now about 12 percent. But this statistic (a) ignores the large volume of duty-free imports (over half of the total) and (b) fails to give adequate weight to the inhibiting effect on imports of prohibitive tariffs and of import quotas. Current measures of tariff levels may be misleading in any particular case and certainly are inadequate to measure changes over time or differences among countries. I commend this problem of measurement to the researchers. Perhaps UNIVAC could help.

Nevertheless, United States tariffs are now at least moderate (the aver-

age effective rate of dutiable tariffs has decreased 74 percent since 1934) and complaints tend to be directed not to the level in general but to those items in the schedule that are still "high." Of the 4,700 odd items in U.S. Import Schedule A, about 400 are dutiable at 50 percent or more.

### *The Escape Clause*

The exception to our general tariff policy that most concerns other countries is the so-called "escape clause," which permits the United States to withdraw or modify a concession, if as a result of the concession, imports are entering in such increased quantities as to cause or threaten serious injury to the domestic industry producing like or directly competitive articles.

Here again the United States bark has been much worse than its bite. Of the thousands of commodities on which tariff concessions have been made, only 65 have been the subject of an application for action under the escape clause. Of these 65 cases, 5 are pending and, as of December 21, 1955 only 17 had been referred to the President for action. Of these 17, the President has decided to invoke the escape clause in only 6 cases: felt hats (1950); hatters fur (1952); dried figs (1952); alsike clover seeds (1954); watches (1954); and bicycles (1955). One, cerium alloys, is now before him for action.

The modification of U.S. tariffs under the escape clause has not so far increased the general level of the U.S. tariffs since the United States has been able to give compensation for tariffs increased by reducing other U.S. tariffs. Whether we will be able to make compensations for future actions under the escape clause is a different question, since we now have authority to reduce tariffs (except those over 50 percent by a maximum of 5 percent a year for the next three years).

Nevertheless, there is widespread concern abroad that any really effective effort to break into the U.S. market will be frustrated by tariff increases under the authority of the escape clause. This concern has increased as the result of changes made by Public Law 86 of the 84th Congress, which make a segment of domestic industry eligible for protection under the escape clause, even though the entire industry is doing well. Thus, if the Widget Division of the automobile industry is threatened by imports, it would be eligible for protection even though the production and profits of the industry as a whole were at an all-time high.

### *Peril Point*

A second concern of foreigners is the peril point provisions of our tariff legislation which provide for findings by the Tariff Commission prior to any negotiations of the minimum rates of duty needed to pre-

vent causing, or threatening to cause, serious injury to domestic industry. The Tariff Commission may indeed recommend increases in existing rates. If the President disregards any of the recommendations of the Commission, he must report the reasons therefore to the Congress.

Here again the U.S. bark is worse than its bite. Although this provision has been mandatory since 1951, it has measurably affected only the 1955 U.S.-Japanese Trade Agreement—an agreement that nevertheless, so far at least, has been quite successful.

### *Section 22*

Another inhibiting factor in expanding sales to the United States, in the view of foreign governments and exporters, is Section 22 of the Agricultural Adjustment Act of 1933. This section permits the President to impose either additional fees or quota restrictions on imports of agricultural products that would render ineffective or materially interfere with any agricultural program. Import quotas on a considerable number of agricultural products are in effect under authority of this section although restrictions have recently been removed on oats, barley, edible tree nuts and tung oil. The relation of these quotas to our domestic agricultural program has been clearly identified by Professor Witt in his paper.

### *Customs Procedures*

A fourth concern of foreign exporters is the complexity and uncertainty of our customs procedures and the delay in authoritative determination as to the applicable rate of duty. However, the rate of handling has been accelerated both as the result of administrative action and of the Customs Simplification Acts of 1953 and 1954. Two years ago the backlog of cases totaled 900,000 and the average time required to determine the duty was 12 months. Today the backlog is down to 600,000 and decisions are being made within six months.

Progress in customs simplification would be further accelerated by the enactment of the Customs Simplification Act of 1955, which was passed by the House of Representatives last summer but not acted upon by the Senate before adjournment.

### *Buy American Act*

One handmaiden of the high-tariff days still with us is the Buy American Act of 1933. This additional obstacle that foreign suppliers have to hurdle in competing for government business in the United States has constantly been represented by such suppliers and their governments as being wholly inconsistent with our professed tariff policies. Recently the Administration standardized and substantially liberalized the ad-

ministration of this act—the basic domestic preference is now only six percent (12 percent in certain surplus labor areas) as compared to as much as 25 percent previously.

#### *Cargo Preference or 50-50 Shipping Provisions*

A sixth departure from our general trade policy that has been the object of complaint, particularly by maritime nations, is the requirement that not less than 50 percent of any goods financed by the United States, whether by loan or grant, be transported on U.S. flag vessels. The argument universally used to support this position is that of defense, and great emphasis is placed on the difficulties that the absence of a U.S. flag merchant fleet created for us in both World War I and World War II,

The above by no means exhausts the list of apparent contradictions to our protracted general trade policy. I might mention, for example, Sections 3(a)(4) and 7(b) of Public Law 86, 84th Congress, giving the President the rights, respectively, to withdraw tariff concessions or to impose quotas on goods of any country because it discriminates against the United States, and to adjust the level of imports of any article the volume of which threaten the national security. Sections 336 and 337 of the Tariff Act of 1930 provide that tariffs may be increased for reasons of equalization of costs of production (336) and for unfair practices in import trade (337). One also might mention the "tied loan" policy of the Export-Import Bank, meticulously elaborate regulations under the Food and Drug Act, countervailing duties against imports subsidized by foreign governments, anti-dumping duties on imports exported at lower than domestic prices, and also that recent innovation, attempts to restrict imports through "voluntary" agreements with importers, as in the case of oil, or through "voluntary" agreement among exporters, as in the case of Japanese textiles.

All in all, the above represents a formidable bill of particulars. Also the 5 percent a year for 3 years authority, under H.R.I, hardly represents the ultimate in an avowed policy of trade liberalization. Nevertheless, I am not prepared to be as pessimistic as Professor Kindleberger. In a democracy, progress is more apt to be made by tacking against the wind than by trying to sail into the teeth of it. After all, our small boy did get to school!

## CANADA'S INTEREST IN U.S. TARIFF POLICY

DONALD B. MARSH  
*McGill University*

I AM STICKING to the title that your chairman suggested to me as an appropriate one for my remarks this evening. Nevertheless, I may devote less time than you might expect to Canada's interest in American tariff policy in order to develop more fully what is properly perhaps only a footnote to our discussion: *viz.*, America's interest in *Canadian* tariff policy. Indeed, I should hope that in this statement and in subsequent discussion we can establish that American and Canadian tariff policy, and their commercial policy in general, should be and inevitably are uniquely interdependent.

### I

Canada's interest in American tariff policy can be stated very briefly. It is simply that the United States should in general reduce or abolish her tariffs, should not bolster domestic prices with a variety of tariff and quantitative restrictions, and, to be still more specific, should not adopt a program of "disguised lend-lease" to move her wheat surplus into foreign markets!

I agree with our chairman that the United States has great power and independence in her choice of a trade policy. In other words, the United States is a "strong, rich country." As such she can afford to be virtuous and lead the way toward a more liberal trading world through the unilateral reduction of her tariffs. This is greatly in Canada's interest not only, or even perhaps primarily, because of the direct effect of opening the American market to Canadian exports, but because of the effect of liberalization on the dollar earnings of Canada's overseas customers.

In fact, I would suggest a corollary to Professor Kindleberger's theorem that an increase in U.S. imports produces an equal and opposite effect on the U.S. trade balance through an increase in U.S. exports. An increase in U.S. imports may increase Canadian exports to overseas countries; and since Canada sells only for dollars (Canadian or U.S.: hard or soft!) this means that some of the U.S. dollars paid for U.S. imports go to Canada. Eventually these dollars may be used to buy U.S. commodity exports; but, in addition to any reserve build-up, they may also be used for investment in the U.S.; for the payment of interest and dividends to U.S. investors; or for the repatriation of debt payable in U.S. dollars. I realize that some of these items are autonomous and not immediately affected by changes in dollar earnings; but they would all be affected eventually. Moreover, there is no reason why we should not consider the

welfare of the U.S. exporters of securities and other evidence of debt; but I doubt very much that U.S. protectionist interests have these gentlemen in mind!

## II

But having said this much, I would like to switch, at any rate for the moment, to my promised discussion of America's interest in Canadian tariff policy.

Canada is beginning to develop some "strong, rich country" problems of her own. Professor Kindleberger has already listed some of the symptoms; and I would say that, to a significant degree, Canada has them all.

1. Her tariff is a means to effect an income distribution favourable (a) to certain sectors, (b) to certain noncompeting groups within those sectors. Admittedly, this is not the only effect of the Canadian tariff; but I submit that the removal or reduction of many protective rates would result in greater efficiency in the industries affected rather than blue ruin and a drastic reallocation of economic resources.

2. Regional interests in favor of protection or free trade operate very much the same as in the U.S. Canada's western farmers are free trade for the same reason that the U.S. cotton south was free trade: *viz.*, they produce an exportable product at a competitive price in the world market. As Professor Kindleberger pointed out, this fact also explains the protectionist sentiment of the Middle West and Great Plains farmers of the United States.

The Canadian West, particularly British Columbia, like certain areas of the U.S., may now be free trade only because of a cultural lag. They have not realized yet that in some respects they are already "out-easting" something vaguely called the "East." The East (to people in the West) is something inherently wicked, and is the presumed stronghold of finance capitalism in Canada. The East itself breaks down into Quebec and Ontario, each claiming financial supremacy: St. James Street *vs.* Bay Street. But *really* down east in the Maritimes, Quebec and Ontario are "central" Canada, or sometimes just "Canada." The Maritimes, unlike the far West, cannot be accused of supporting free trade because of a cultural lag. They really do need free trade. Their natural metropolis is Boston, not Montreal.

3. In terms of factor proportions, too, Canadian experience parallels that of the United States. Plentiful land and natural resources, scarce labor, scarce but "politically ascendent" capital. Today, both resource development and manufacturing are capital intensive. For example, modern mining and refining are extremely sparing of labour, long on equipment: a series of automatic processing points joined by conveyor belts. The same is largely true of primary manufacturing development

such as ALCAN's great Kitimat project. And of course mass-production industries have interests similar to their counterparts in the U.S., provided always that they can achieve something like optimum output from the market available to them. In spite of recent difficulties, Canada has certain natural advantages in textile manufacturing. It is the limited Canadian market and protected foreign markets that keep this industry in the protectionist camp.

4. Finally, I believe Professor Kindleberger's import-export theorem applies also to Canada. We, too, can benefit by casting our bread upon the waters. Increased imports from overseas countries mean increased exports to our natural markets abroad. Again, our corollary operates, and some of the Canadian dollars will be used to buy U.S. exports. In other words, the theorem is universally true only if we treat the U.S. and Canada as a North American trading unit.

### III

All this suggests that the U.S. and Canada might contribute to the solution of each other's trading problems by some kind of special arrangement, some sort of "North American preference" or, better perhaps for old times' sake, "reciprocity."

We already have mutual free trade in agricultural implements. Massey-Harris can make all its tractors in the U.S. and all its combines in Canada, with both countries getting the benefit of mass production for the whole U.S.-Canadian market. Why couldn't Chrysler make all its Plymouths in Detroit and all its New Yorkers in Windsor? Or GM make all its Buicks in Oshawa and all its Chevrolets in Flint? Ford does make all its Meteors and Monarchs in Canada. But these are largely, on the face of it, un-economic product differentiations from Ford and Mercury respectively.

Even Canadian textiles might stage a come-back if there were mutual free trade with the U.S. in their products. Perhaps the old reciprocity is dead. Nevertheless, we might regain some lost ground through this kind of gradualism. I realize the difficulties, even the dangers, in any kind of free-trade area for the U.S. and Canada, however limited by commodities and industries. But I shall leave elaboration of these to the general discussion to follow; and I hope that this point and some of the others I have mentioned will receive the attention appropriate to our *mutual* interest in America's tariff policy.

## THE DYNAMICS OF FOOD RETAILING\*

Chairman: Joseph Ackerman, Farm Foundation

### MOVEMENTS IN THE RETAIL DISTRIBUTION OF FOOD IN THE U.S.

ROBERT W. MUELLER  
*Editor, Progressive Grocer*

IT IS A great pleasure to talk to you about food distribution. Food retailing has undergone amazing changes in the past decade. More has been accomplished in food retailing than in any other field and more is still to come.

Today, I shall try to touch on some of the changes of recent years—what they mean to marketing. Perhaps the best way to approach this question is to break food retailing into its several elements and examine each one. These elements are:

- Independents versus Chains
- Share of Sales by Size of Store
- Size and Nature of Store Inventory
- Retail Prices and Margins
- Wholesaling
- The Human Element in Retailing
- Merchandising

#### *Little Change in Chain-Independent Sales Ratio*

First, let's look at the independent-chain picture over the past two decades. It may come as a surprise that the independent-chain ratio

CHAIN-INDEPENDENT  
SHARE OF GROCERY SALES

	1933	1941	1943	1945	1947	1949	1951	1952	1953	1954
Independents	66%	66%	71%	72%	68%	66%	65%	65%	64%	64%
Chains	34%	34%	29%	28%	34%	34%	35%	35%	36%	36%

is not much different today from what it was in 1933. Defining chains as operators of 11 or more stores and independents as ten or less, we see that there has been a change of only two percentage points in the past 22 years.

The war brought an automatic advantage to independents, and in 1945 their share rose to 72%. But when war shortages and restrictions

\* Joint session of the American Farm Economic Association, the American Marketing Association and the American Economic Association.

disappeared, chains reclaimed their former 34% of sales and have succeeded in lifting this to 36% for the year just past. For the first eight months of 1955—chain sales are up 6.4% and independents 5.2%.

### *Retailing Talent Evenly Divided*

And so today it looks like retailing talent is divided about equally between chains and independents. Each has its advantages. Chains find it easier to obtain capital to finance new stores and often get first crack at new locations. Chain organizations enjoy greater experience, particularly in marketing research. Their uniformity in store appearance, in products handled and their reputation for low prices tends to attract business.

Offsetting chain advantages are the flexibility of the independent operator, his ability to act fast in buying, promotion, pricing. Independents have always had this flexibility, but it is only now that they are really taking advantage of it. The independent operator has a personal incentive that gives him the edge over the paid manager. He is working more effectively with other leading independents and with wholesalers. And today, there is a flow of information that enables the alert operator to keep abreast and even set the pace in merchandising. But the factor that contributes most to the present equality in retailing is the ability of the independent to buy his goods from low-cost wholesalers at prices that enable him to be price competitive and at the same time realize a satisfactory profit.

### *The Continuing Trend to Super Markets*

Although there has been little change in sales in terms of store ownership, we have seen a veritable revolution in sales by size of store, both in the chain and independent ranks. Let's go back just a few years so that we can get a better understanding of the phenomenal growth in the share of total sales done by super markets, stores defined as doing \$375,000 or more annually.

THE GROWTH OF SUPER MARKETS

	% of Stores	% of Sales
1939	1.4	4.4
1948	2.7	31.0
1952	4.4	43.8
1954	6.0	53.5

It seems incredible today, but as recently as 1939 super markets operated by chains and independents controlled a meager 4.4% of U.S.

grocery store volume. Nine years later, in 1948, their share had grown to 81%. Super markets claimed 43.8% in 1953 and topped the 50% mark for the first time in 1954.

There is no mystery about the growth of super markets. Most important to their growth have been the application of self-service, the increase in number of automobiles, congestion on Main Street, the consumer's natural desire for one-stop shopping, low prices, fresh merchandise and a whole new generation raised on self-service, cash-carry groceries.

### *Super Markets, Superettes and Small Stores*

But let's pause a moment to view U.S. food stores in total, so that we can get a better perspective of where we might be five years hence.

Retail food stores are best classified, we believe, in three ways: (1) super markets, stores doing more than \$375,000 business a year, (2) superettes, stores doing \$75,000 to \$375,000 a year, and (3) small stores, those doing less than \$75,000 a year.

GROCERY STORE SALES—1954\*

	Super Markets		Superettes		Small Stores	
	Stores	%	Stores	%	Stores	%
Chains	11,140	30.9	7,200	5.3	700	.1
Independents	10,300	22.7	60,200	23.6	265,100	17.4
Total	21,440	53.5	67,400	28.9	265,800	17.6

\* Total grocery sales \$36,860,000,000—total grocery stores 354,640.

At the start of 1955 there were 21,440 super markets divided about equally in number between chains and independents. They accounted for 53.5% of total sales.

There were 67,400 superettes, most of them independent, and they did nearly 30% of total sales. They, with super markets make up 24% of the number of stores and do more than 82% of total sales. These two blocks of stores, in the opinion of most marketing men, represent a basic distribution coverage if a manufacturer is to get full value from his consumer advertising dollar and if he is to make his product available to the American shopping public.

Although small stores have been closing up at a rate of about 5,000 a year for the past 10 years, there were still 265,800 of them operating at the beginning of 1955. They did only 17.6% of total sales in 1954. Yet, there will always be a preponderance of small stores, particularly in large cities and in very small towns.

*Sixty-five Percent of Sales in Super Markets by 1960*

What can be predicted for the near future? The pattern seems quite clear. Super markets will continue to increase in number and in share of market. There should be at least 25,000 super markets in 1960, for our population increases are sufficient to support about 1,000 new super markets a year, each doing \$1 million of business a year. Their share will approach 65% of total sales. They will not all be new stores, for many will be former superettes that have moved up into the super market volume ranks.

There will not be a drastic change in the number of superettes or in their share of total sales. This class is not easy to evaluate, for it is a class that is fed from the bottom as small stores gain in size and on the other hand loses in numbers as present superette operators graduate into super markets.

Small stores seem destined to decline in number and in importance even more. Some 25,000 will close shop in the next five years, and their share of sales may go as low as 12%.

If these forecasts come true, super markets will control 65%, superettes 23% and small stores 12% of total sales in 1960.

That's a broad picture, and I think we should be aware of an unusual development within the super market field in recent years. That is the spectacular growth of the local super market operator, in general the operator of one to ten units. For the past three years these operators have achieved sales gains double those of chain super markets, and they have been increasing faster in number than their larger corporate competitors. Furthermore, they are unusually promotion minded and rely almost entirely on national brands.

*The Size and Nature of Store Inventories*

Food store inventories, like the stores themselves, have undergone a remarkable change in recent years.

<i>Number of Items Stocked in Food Stores</i>	
1928	867
1946	3,000
1950	3,768
1955	4,723

Back in 1928 a good store handled something more than 800 different items in groceries and perishables. At the end of the war this had gone to about 3,000. Inventory increased to nearly 4,000 in 1950 and today an average super market carries nearly 5,000 different items.

What kind of a store is needed to handle an inventory of this scope? Here is a view of what we can consider an average new super market.

It measures some 15,000 square feet in total building area, about 11,000 square feet to the sales area, and about 3,600 feet to the actual display of merchandise. Perishables, now accounting for more than one-half of store volume, occupy the perimeter of the store, while groceries are concentrated in a center-of-store location. Perishables and groceries each occupy about the same amount of space, yet there are four times as many grocery items to order, to stock and to allot space for as there are perishables. This has brought up many problems not only for the retailer but for the manufacturer whose product must depend on proper recognition at headquarters and store level.

#### *More . . . or Less Space for Each Item?*

Each item has many more competitors than it used to have, all competing for initial stocking, for proper re-ordering, for facings, for favorable shelf position, for advertising, for special display and for promotion.

This comparison may help to bring out the point involved. Twenty-five years ago the average canned fruit item competed with 23 others. Today it competes with 139 others. Flour and mixes competed with 17 then and 109 now; cereals with 16 then and 91 now, and similar comparisons run through the whole inventory. And so, even though size of store has increased enormously, size of inventory has increased in nearly the same proportion. As a result, the space allotted per item hasn't changed much in the last 25 years, and for many items the space available has actually decreased.

Let us look for a moment at how some of this increase in number of items has come about. Here are typical examples of increases in number of items handled:

NUMBER OF ITEMS BY PRODUCT GROUPS

	1928	1950	1954
Frozen Foods	—	121	149
Dairy	44	158	185
Beverages	26	133	194
Soaps and Detergents	37	65	95
Household Supplies	51	175	377
Paper Products	—	52	75
Canned Vegetables	42	166	185
Canned Fruits	24	94	139
Flour and Mixes	17	84	110
Drugs & Toiletries	—	185	300
Candy, Gum, Nuts	34	190	191
Soups	4	48	67
Baby Foods	—	108	183
Cereals	17	60	92
Canned Meats	7	44	57
Total	303	1,678	2,399

Frozen foods have added 149 new items to the store inventory, soaps and detergents have climbed from 37 items to 95, household supplies have increased by leaps and bounds and all other classes of product have shown big gains. The over-all increase, of course, has come from two sources—new products, and a greater number of items of nearly every old product.

A conservative prediction is that size of inventory will range at around 6,000 within the next few years, most of which will come from frozen foods and other convenience food products, and relatively little from so-called nonfood merchandise. It should also be pointed out that each year hundreds of items disappear on super market shelves, for the mortality rate is about two-thirds of the birth rate in terms of items handled.

#### *Eighty Percent of Grocery Items Sell Less Than A Case Per Week*

In looking to the future and in considering marketing and merchandising plans, we feel that the manufacturer must know more about sales of his type of product in the average super market. Our recent study on sales and margins by product groups in Foodtown Super Markets revealed some surprising facts that have upset a lot of old notions. For example, one such fact is that the super market does not sell a great many cases of each item per week. It achieves volume by carrying thousands of different items and moving only relatively small quantities of each item.

Of 2,983 grocery and frozen food items carried, 2,383 (79.9%) sold less than one case per week, 524 (17.5%) sold 2 to 5 cases per week, 50 (1.7%) sold 5 to 10 cases per week, and 26 (.9%) sold more than 10 cases per week.

Nearly 80% of the total number of items handled in grocery and frozen foods sell at a rate of less than one case of 24's a week. And less than 1% of the items move at a rate of more than 10 cases per super market per week, even in a store twice as large as our average super market. *The average sales per item in the average super market is about nine units per week.* This has come as something of a shock to many marketing people, who automatically associate a volume of 5, 10 or 20 cases per item per week with the super market. But it just isn't so. Distribution in 60,000 to 80,000 stores (approximately 20% of the total number of stores) is needed if a product is to approach its potential.

The vast number of items, most with relatively small sales, lies at the root of our current out-of-stock problem, for it has become increasingly difficult to order, stock and promote each item in terms of its actual consumer demand.

But this new look at sales per item per week has its bright side too. Recognition of this fact makes it easier to introduce new items. The general manager of one of our largest chains told me that if a manufacturer had asked him a year ago what kind of volume was needed to warrant taking on a new item, his offhand answer was "two to three cases per store per week." After studying our Foodtown report, he had his own sales analyzed in similar fashion, and after learning the facts, he now believes that any item selling a dozen units per store per week deserves very careful consideration.

#### *New Products Account for Twenty Percent of Total Sales*

As we look to 1960, we must also consider the role of new items. To get some basis on which to estimate their importance in the future, let us review for a moment the part they play in the 1955 food store.

NEW PRODUCTS: LIFE BLOOD OF A GROWING RETAIL INDUSTRY

	% of Total Store Sales		% of Total Store Sales
Ice Cream	.70%	Grass Seed	.04%
Dessert Whips	.11	Insecticides	.02
Beer & Wine	.80	Cello Tape	.05
Frozen Foods	4.14	Dish Cloths & Towels	.01
Instant Coffee	1.71	Oil and Lighter Fluid	.01
Cigarettes	3.41	Frosted Cereals	.18
Synthetic Detergents	1.61	Baby Meats, Juices	.18
Candy and Gum	1.48	Pet Supplies	.04
Powdered Milk	.03	Party Foods	.13
Paper Products and Film & Foil Wraps	1.96	Drugs & Toiletries	1.85
Light Bulbs	.11	Flour Mixes	.92
Sponges	.01	Dietetic Foods	.14
Powdered Bleach	.04	Misc.	.25
		Total	19.91%

After viewing this summary, we must agree that new products are not only the life blood of the retailer, but also of utmost importance to the manufacturer. New items, those new to our economy and those not formerly sold in the food field but which are now a part of the inventory, contribute nearly 20% of total store sales, and when we match their sales against grocery department sales, we find that they constitute more than 45% of grocery volume.

We can conclude that, in spite of retailer protests to the flood of new items, new and better products are gaining and will continue to gain acceptance by retailers and represent important new sales opportunities for manufacturers.

*Super Market Pricing—Good for Consumers and Manufacturers*

Manufacturers and consumers have a great stake in food store margins, both now and in the years immediately ahead. Margins have steadily declined over the years, a trend that has contributed immeasurably to the success of food store products and to the well being of the food industry and the public as well. These few examples are typical of the wonderful economies made possible by the advent of self-service and the one-stop shopping we enjoy today.

HOW MARGINS HAVE DECLINED

	1928	1954
Fresh Meats	29.4%	16.9%
Beverages	22.7	10.4
Cigarettes	23.7	5.8
Soaps	23.3	8.4
Canned Vegetables	28.8	20.8
Sugar	22.4	6.2
Salad Dressings	26.0	16.0
Canned & Powdered Milk	19.5	8.5
Cereals	24.5	13.3

Margins in fresh meats have been cut nearly in half, beverages, by more than one-half, soap margins have declined nearly two-thirds, with reductions realized in nearly every category of product handled in the food store. As a result, food stores have become the world's most efficient retailing system.

COMPARISON OF MARGIN ON SALES BY STORE TYPES

Food Stores	17.9%*
Gas Stations	22.6
Hardware Stores	28.8
Department Stores	30.7
Men's Furnishing Stores	32.8
Drug Stores	33.2
Furniture Stores	37.5
Jewelry Stores	42.1

\* Foodtown.

The consumer gets more for her money in the food store than in any other kind of retail store. In this age of discount houses and fair-trade controversy, the super market attitude toward pricing is unique. The retail food industry has developed a free and realistic pricing philosophy that benefits retailer, consumer and manufacturer.

*Higher Margins Ahead*

How about margins in the period ahead? There is difference of opinion

here, but most leaders in the trade believe that margins will edge upward in the years ahead, just as they did in 1953 and 1954. An educated guess might put the store margin at 19% in 1960, compared with 17% to 18% at present. More elaborate stores, more services, better employees, fewer loss leaders, an increase in the sales of frozen foods that carry higher handling costs, will all contribute to this gradual rise in the margin rate.

#### *Fewer But Better Wholesalers*

There has been a revolution, or perhaps we should call it an evolution in wholesaling, too. Although the number of wholesalers has not declined appreciably, we find that the better wholesalers are taking over a much larger share of wholesale sales. Retailer-owned cooperatives like Certified Grocers of California have lifted their volume sharply. This concern did \$35 million in 1945—and more than \$225 million in 1955. Since wholesale grocers usually supply about 25% of the dealer's needs, this \$225 million is equivalent to about \$900 million in terms of retail sales. Voluntary group sponsors are becoming more important. A leading voluntary sponsor, Super Valu, boosted its sales from \$13 million in 1945 to \$107 million in 1955. The Fleming Co.—an IGA wholesaler—another leader, increased its sales from \$5 million in 1940 to \$76 million in 1954. There are scores of similar successes in wholesaling. Although these organizations offer many advisory services to the retailer, their success rests primarily on the lower prices that they offer to their retail accounts.

#### *How Preprint Order Forms Affect Manufacturers*

Preprint order forms achieve low wholesale prices in many ways. Perhaps the most important is the use of the preprint order form that eliminates the need for and the expense of wholesaler salesmen and reduces wholesaler operating expenses by 20% to 35%. Nearly 30% of the nation's wholesalers now use this method. The order form has special significance for the manufacturer today and will become even more important in the future. The order form saves time for the retailer, gives him more time for management and merchandising. It also makes it more difficult for the wholesaler to push private brands. Furthermore, it puts the retailer on a self-service buying basis, and like the consumer, he is prone to buy a wider variety and greater quantities when not put under personal pressure by the salesman who runs down a long list asking, "How are you fixed for?" after each item.

But the preprint order form puts a new responsibility on the manufacturer, for it becomes squarely up to him to see to it that product information and news go to the retailer regularly and effectively.

### *Mergers in Food Retailing*

In the U.S. business as a whole there have been more mergers this year than in any other since 1929. Our records, and they are not complete, reveal 36 mergers or acquisitions in the first nine months of 1955. In these 36 deals, 610 stores were either bought by or were merged with other companies. These stores represent about 3% of the nation's supermarkets.

We have questioned many of the "mergees" to try to find out why they bought, sold or merged. In general, these are the motives: They buy because the retail business is extremely competitive and because new locations are hard to find. The big chain finds it easier to expand through buying than it does through building new stores. This makes sense because the records reveal that the big chains are finding it difficult to maintain their share of total sales through normal growth. For example, the six biggest chains did 25.08% of total grocery sales in 1941, 23.21% in 1950, and at the beginning of 1955 their share was 23.02%.

### *Why Does an Operator Sell?*

There are several reasons for an operator selling. First, the offers are fabulous. Second, our federal income and inheritance taxes virtually dictate this solution for the man who has built a good business within his own lifetime but has little cash.

We do not feel qualified to comment on whether mergers are good or bad for our nation, for free enterprise, or for business. We do feel, however, that the trend to private brands, already given great impetus since World War II, will gather momentum even faster. It stands to reason that when a strong believer in private brands buys a smaller company that had confined itself to "outside" brands—the private brands will tend to displace some of the outside or national brands.

Periods of abundance like the present always favor controlled brands and, since the major chains are vigorously promoting their own brands in frozen foods with great vigor and success, a larger rather than a smaller share of sales for private label merchandise is indicated in the immediate future.

### *Retailers Grow in Stature*

No discussion of food retailing would be complete without a word about the men who run the nation's stores. Unfortunately, some manufacturers and economists have had a tendency to underestimate the food retailer, to think of him as he appeared 25 years ago, a kindly, but rather ineffectual small shopkeeper. So, it should be kept in mind that with the changes in our stores have come pronounced changes in the people who operate them.

We were frankly surprised to find, on surveying our own readers, how high the food retailer has risen in the ranks of American businessmen. The average income among super market operators is nearly \$25,000 a year, they have an average investment of more than \$100,000 in their business, and nearly one-half of them have attended or have been graduated from college. And the caliber of chain managers has been on the upgrade as has that of the store operator. Chain managers are better trained, better paid. They have better formal education. They are being given greater responsibilities and more young men are coming into the business than ever before. The wise manufacturer in 1960 will recognize this change in the human side of our business.

#### *Merchandising Opportunities for the Grocery Manufacturer*

As of now, the most dramatic development in the wind is the surge of frozen foods. These foods now account for 4% of total sales and are expected to reach 8% and even 10% of total sales in 1960. If fresh meats can be successfully marketed in frozen form, the per cent will be much higher. Fresh produce is also on the verge of a great change. It is the last frontier for complete self-service in the food store. The problem is now being studied by leading retail organizations all over the country, and by 1960 we expect to see prepackaged, prepriced produce departments established firmly in the better retail food stores.

#### *Monotony in the Grocery Department*

What about the *grocery department*? This important classification has taken a back seat since the war because of the dealer's concentration on self-service meats, frozen foods, and now on prepackaged produce. As a result, the grocery department, with its 3,000 odd items, has often been neglected, and today we have a grocery department arrangement that can be described only as monotonous and confusing to the shopper. Next time you're in a super market, detach yourself from the crowd and your own problems and watch the customers. You may be impressed with the customer's speed in going down one aisle, up another, and in the process not really seeing more than perhaps 10% of the items available.

Add to this monotony our growing out-of-stock condition, our scarcity of sound and compelling ideas for special displays, our admittedly faulty allocation of space to each item, and there we have some reasons why grocery merchandising has been lagging.

We are living in an era of deals and gimmicks. Coupon distribution has increased from about 160 million in 1946 to more than a billion in 1955. By 1960 their use is expected to reach 1½ billion. We see no let-

up in deals or coupons—but we do expect more attention to be paid to better grocery merchandising at the store level. We think that such merchandising, whether developed by the retailer or the manufacturer, must have this major purpose: *to departmentize the grocery department more clearly. In other words, the customer must be impressed with the fact that the grocery department is actually many little stores within a store.* She must be fully exposed to all its groups and made aware of the many sections that look alike and yet are different. She must be more aware that here is the soup department, the canned fruit department and here all the rest. With few exceptions, manufacturers, in their intense brand versus brand competition, have neglected this opportunity. Marketers must know more about the influence of facings, shelf height and product position if they are to work more effectively at the point-of-buying decision.

When that is accomplished, consumer purchases and dealer activity in promotion, pricing and display will all be increased. A whole new opportunity for brand promotion will open up, and manufacturers who contribute will realize direct benefits.

This is not an easy job. It will succeed only in so far as the manufacturer is able to impress on the dealer the importance of his category and the importance of his brand within the category. It will also depend to a great degree on the assistance manufacturers can give to operators in developing more accurate methods of ordering, better shelf stocking and also in the use of effective special display when and if a product merits such favored treatment. Several manufacturers are already doing a good basic job along these lines.

Of course, better cooperation between manufacturers and retailers will be speeded up greatly as sales and marketing men gain a better understanding of the significant changes in the caliber of the men and women responsible for the operation of leading chain and independent food stores.

## DEVELOPMENTS IN SELF-SERVICE FOOD DISTRIBUTION ABROAD

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**T**HIS paper deals with the following three questions:

1. How far has self-service and super market development in food distribution progressed to date abroad?
2. What are the major differences in conditions abroad compared with the United States (and Canada) affecting self-service and super market developments?
3. How far is self-service and super market development likely to go abroad in the next five years?

### I

Self-service and super markets are manifestations of the American way of life that have captured the imagination of many people throughout the world, and those who have tried it, or have been exposed to it, like it. To be sure, perhaps ninety percent of the world's people haven't been near a self-service food store. Most of them may have never heard of a super market. But that situation is and will be changing. There are stirrings even behind the Iron Curtain, with at least a superette in operation in Tiflis and a super market under construction (perhaps already in operation) in Leningrad.

The National Cash Register Company, an advocate of self-service, has been compiling data on the number of self-service food stores outside the United States and Canada. As of two months ago there were nearly 10,000 such stores in more than 40 countries. This represents an increase of 28% in ten months. There were practically no self-service food stores outside the United States and Canada before 1947.

About three-fourths of these self-service food stores are in Western and Northern Europe. No self-service food stores are known at present in Southern Europe and probably none exist in Central Europe.

In relation to population, Sweden, Norway and Switzerland lead at present in Europe. These three small countries with a combined population of fifteen million people account for 45% of the self-service food stores in Europe. New Zealand and Australia are also leaders in the self-service movement. They account for about one-sixth of the total abroad.

Suggestions have been made that the self-service food store, and especially the super market, thrives best in areas of high standards of living. In the main, the record to date appears to support this.

## SELF-SERVICE FOOD STORES IN OPERATION OUTSIDE USA AND CANADA

Continent and Country	Population in Millions	Self-Service Food Stores		Increase Over December 31, 1954†
		October 31, 1955†	Per Million Population	
<i>Europe</i>				
England	50	2,413	48	24%
Sweden	7	2,100	300	19
Norway	3	701	250	61
Germany (West)	48	529	11	89
Switzerland	5	500*	100	10
France	43	386	9	21
Netherland	10	302	30	31
Denmark	4	195*	49	4
Belgium	9	97	11	36
Finland	4	44	11	7
Austria	7	35	5	118
Subtotal	190	7,902	38	28
Australia	9	1,156	128	20
New Zealand	2	554	277	35
Subtotal	11	1,710	156	24
Central and South America	150	662	4	28
All other	—	78	—	170
Total		9,752		28

† Data supplied by The National Cash Register Company.

\* Revised on basis of data from other sources.

About half of the self-service food stores abroad are operated by consumer cooperatives; the balance, by both chains and independents. The chains that were more cautious to get started are stepping up the tempo of their activities.

Although there are no statistics, it is probably a valid conclusion that most of the present self-service food stores abroad are conversions from service stores. Thus they are stores *in situ*, with some remodeling and perhaps a bit of enlarging. They are small stores averaging about 1,000 square feet, located in congested, densely populated urban areas, without parking and with inadequate, cramped storage and service areas and facilities. Such superettes cannot carry a large selection of merchandise.

My guess would be that less than 300 of the 10,000 self-service food stores abroad are complete food stores, with a wide selection of groceries, fresh fruits and vegetables, dairy products, baked, smoked and fresh meat and fish. These stores will range in size from 3,000 square feet to more than 10,000 square feet and their sales volume is large enough to be considered super markets.

## II

The development of self-service in food distribution abroad has been hampered more or less by several handicaps. To begin with, there is tradition to overcome. Tradition means a myriad of small or tiny food-specialty stores and stands, and it means customer service. Tradition has deep fears of customer pilferage under conditions of self-service merchandising. Tradition induces the businessman to spin out a long list of reasons why housewives in his country are so different from those in the United States and consequently wouldn't respond favorably to the self-service way of life. Finally, tradition sees no urgent need for changing anything when one can still make a profit, or a living of sorts, by doing things the tried and known way.

Then, there were all the problems of the aftermath of the war: destruction, shortages, rationing, restrictions and a bit of general confusion. These were all real difficulties that tried the courage and patience and ingenuity of even the most enterprising and progressive businessmen. Raising capital to finance new enterprises is not easy abroad, and finding suitable locations even for superettes is troublesome. As for getting supermarket sites and buildings, the difficulties multiply in geometric progression with the increase in size of the store desired. It is a sad fact that in reconstructing the war-bombed cities of Europe, the local governments, the city planners and the property owners all combined to rebuild the shopping facilities essentially on the prewar scale and needs. They looked at the dead past and planned accordingly for the future. And the businessmen failed to organize a movement to prevent this blunder.

Prepackaging is essential for self-service. In the United States the suppliers are now performing the prepackaging of nearly all products except fresh fruits, vegetables, meats and fish. This is not the case abroad. There prepackaging is still far behind, and in many parts of the world it is primitive by U.S. standards. The cost of packaging material is higher abroad than in the United States and people can less afford to pay for it. Consequently, self-service food distribution abroad is beset with far more problems of getting prepackaged merchandise before the customer than is the case in the United States. Fortunately, packaging by retailers and suppliers is improving rapidly and suppliers are taking over more of the prepackaging function.

Self-service is a convenient way to shop, with part of the work in the store done by the customer. This cuts operating expense and the savings can be passed on to the customer as an added inducement. The supermarket is essentially a marriage of self-service and low prices. Unfortunately, abroad it is customary for suppliers of leading grocery brands to insist on resale price maintenance. This of course eliminates com-

petitive pricing from a substantial proportion of lines sold in food stores and thus retards flexibility of pricing as a means of attracting trade. The aggressive merchant tries to meet this situation either by giving cash rebates to his customers on all items purchased, or, in some instances, he features his own private label brands. The super market is a strong challenge to the supplier's right to fix retail resale prices.

The super market aims at one-stop shopping. It does away with the traditional going to the butcher, the fish monger, the baker, the vegetable shop, the dairy store, and the grocery to buy all the products needed to feed the family. This is the antithesis of the guild laws in food retailing, which protect fragmentized specialization in varying degrees in many places abroad. Until these guild laws are repealed the consumer must pay heavily for every attempt at progress.

The problem of selling fresh meats in super markets is especially troublesome in a number of countries, and the only solution permissible at present is to enclose the meat department behind a glass wall with a glass door entrance from the other food departments. An ingenious merchant in Argentina noted that the law in his country said nothing about a butcher selling groceries, so he opened a meat market with a temporary partition to screen off the rear three-fourths of the store. A couple of months later he removed the partition, moved the meat department to the rear, and installed a complete self-service grocery section in the front. The frustrated authorities are still considering whether the merchant is a butcher or a lawbreaker.

Mrs. Consumer abroad who shops in self-service food stores does so more frequently than her American cousin. She is still hampered by lack of refrigeration or very limited refrigeration facilities in the home, and she does not generally have the convenience of an automobile to go shopping. Consequently, her average purchase is relatively small. She assembles her total purchase in a small store basket and carries it home in her personal shopping bag, because even super markets abroad do not as yet provide the convenience of large, strong paper bags in which to take the groceries home.

Complete self-service in all food departments is so rare abroad that it is still practically nonexistent. One or another or all of the perishable departments are on a service or semiservice basis. Self-service fresh meat merchandising is being introduced very cautiously, chiefly because mechanical refrigeration equipment and the necessary transparent wrapping materials are considered very expensive.

Super markets abroad do not carry the large variety of food items available in the United States. The differences are to be found in much less products with built-in services, very little frozen foods, less variety

in fresh fruits and vegetables throughout the year. Also, super markets abroad do not offer a wide duplication of brands and sizes of the same product, with the exception of chocolates and wines.

Self-service food merchants abroad point to much higher sales experience per square foot of store selling area than in the United States. This is so because they carry fewer items and less duplication of brands and sizes, make more frequent grocery deliveries, and customer purchases are better distributed throughout the week, especially since these stores abroad are not open evenings or Sunday.

Food retailers abroad are almost inactive in the use of mass advertising media. Most of the advertising is done by window displays and some newspaper ads. The window displays are very attractive and effective in arresting the attention of pedestrian traffic. There is much window shopping.

Self-service food store personnel abroad are hardworking, but not always well trained in the concepts and methods of self-service merchandising. This is particularly noticeable in the care and handling of perishable products. Because labor is still relatively cheap, mechanization and labor saving devices are not nearly as widely employed abroad as in the United States.

In spite of the high rents and store space limitations, the utilization of the available selling area is not always highly efficient. On the other hand, super market operators abroad are imaginative and very resourceful in utilizing a second story to provide additional selling area. Some of the staircases leading to the upper floors are remarkably attractive and impressive.

One must not fail to mention that nonfood lines have found their way in self-service food stores and super markets abroad as they have in the United States. In some instances, more space is devoted to a larger number of nonfood items than to food products. These, of course, are exceptional stores, generally in a very important shopping-center location. However, their experience is still too brief to foretell what the shakedown in nonfood lines in super markets will be.

In my recent travels abroad, I have seen many peculiarities in self-service food operations. These, pieced together, would make an interesting story. But the situations are probably unusual and perhaps ephemeral. Hence I pass them up, aware that some exception might be found to every generalization I have made.

### III

Having taken a quick and sketchy look at self-service and super markets abroad, let us now turn briefly to likely developments in the next five

years. Here I would like to present some views from several friends abroad who are up to their necks in the super market movement. The following quotes are almost verbatim but somewhat abbreviated. In the case of two, the text represents my free translation of the original in German. Although the names of these contributors are omitted, their countries are carefully identified to give more meaning to their views. In so far as there is repetition, it reveals that these keen European merchants think alike.

*In Denmark.* The independents prefer status quo and are peculiarly resistant to dynamic growth. They place their trusts more in protection than in free competition. Therefore, the consumer cooperatives and a few chains are the only competition elements in the retail trade. But Denmark is "underdeveloped" with respect to chain store organizations. The Danish trade law provides that a retailer may operate only one store in a municipality. A manufacturer may open as many stores as he wants but then only sell his own merchandise and similar products from other manufacturers. A consumer cooperative may operate many stores but is permitted to deal only with members.

It is obvious that this very strange legislation sets strong limitations on competition. The big organizations are the only elements today in Denmark open-minded enough to understand that the interests of Mrs. Housewife, low prices, good quality, right type of stores, etc. are the only healthy road for all business. We have tried for years to change this legislation and perhaps we will succeed within the next five years.

I believe that the self-service system will have a better future in Denmark in the coming five years. The super markets will also come. I am optimistic because every time I hear in Europe that the American housewives have "another mentality" than their European sisters, I know it is a great lie. All human beings want a better life, a better standard of living. Everything we do here to make it easier for Mrs. Housewife is received with enthusiasm. She is happier in a super market than in an old store. She gets more time for her family. She wants progress. She will press her will through.

*In England.* The larger food retail organizations are known to be engaged in close study and preparing plans for further extensions into the self-service field. Stimulus to more rapid development is being provided by a number of firms with only minor previous interests in the retail food trade and these firms are actually leading the trade at the moment in the development of super markets.

There is little doubt that the next five years will see an acceleration of the switch from service to self-service types of shops. Rising overheads, particularly wages, and difficulty of finding suitable staff will provide a strong stimulus. The trend will be for more new shops to be opened up as self-service shops, particularly in new shopping parades. Super markets will increase rapidly in number and in size and one company is already planning to open over the next two years a number of units in excess of 10,000 sq. ft. but the majority are likely to be in the 3,000 to 5,000 sq. ft. range.

Lack of mobility and the shopping habits of the British public are handicaps in any attempt to repeat in this country the pattern of American super market development.

The most likely field for super market development over the next five years will be in main shopping centers and if in addition to the natural advantage of

super market shopping such as wide stock assortment, bright surroundings, ease and speed of shopping, the super markets succeed in under-selling their service trade competitors, even by a small margin, and they establish a reputation for good value, they will be able to establish themselves in off-peak positions. If this is so, the problem of finding right sites will be made a little easier, otherwise lack of suitable sites in good positions in main shopping centers will limit the expansion plans of those companies likely to specialize in super markets.

By 1960, most probably 12% to 18% of the food trade in England will be done by self-service lines and super markets will play an important part in increasing the self-service section of the total trade.

*In Germany.* Within the next five years, we may expect at least 5,000 self-service food stores, of which about a thousand will be of super market rank. During this period will be made the first attempts to establish suburban markets with parking areas for automobile shoppers. Complete self-service meat and produce will be introduced gradually. The industry is heading toward complete prepacking and the progressive companies will capitalize on the opportunities.

*In Switzerland.* During the next five years, cooperatives, chains and large concerns in the food distribution industry will go 80 to 100 percent self-service. The small independents will stick essentially to service, but will also introduce semi-self-service so that the customer can help herself or be served, as she may wish. As for real super markets, I doubt if there will be more than fifty in five years. Opportunities are too limited and store locations are too expensive. Nonetheless, I can foresee super markets emerging on the periphery of large cities and even in the country. It is quite possible that even several shopping centers will be built before 1960.

Our friend from Denmark is enthusiastic and hopeful, the Englishman is conservatively optimistic, the German is determined and confident, and the Swiss has no intentions to let a good thing pass by. In short, they expect more and better self-service and super markets in the next five years, and so do I.

This international development will snowball, just as it did in the United States. The skepticism, the hesitation, and some of the obstacles abroad parallel, in the main, our own experience. It took us ten to fifteen years to get fully warmed up and in high gear. The same, at varying velocities, will be happening abroad, especially as more people acquire home refrigeration and motorized transportation. Sweden has 300 self-service food stores for every million population. New Zealand has 277. These are the two top performers to date abroad. The United States has about 600 self-service food stores per million population—of these about 150 are super markets. Even Sweden still has a long way to go, and things are far from standing still in the United States.

Elsewhere, I have pointed out that in the postwar years the United States has shared generously with other people the fruits of her way of life and that someday the world may yet proclaim the super market as one of the great American contributions to the betterment of standards

of living everywhere. Food merchants abroad who are deeply interested in self-service and super markets—and their number is rapidly multiplying—are most grateful for all the help they have been receiving from our super market industry, from our excellent food trade press, and from many manufacturers of goods and equipment.

Fortunately for all of us, this is not going to remain a one-way street. Those who are now benefiting from our experience and know-how are also acquiring know-how from their own experience. They have minds just as good as ours, and they will come up with ideas and innovations that will supplement and enrich ours, and this will be our reward. The excellent mutual relationships will lead to an international exchange of information that will benefit all people and will result in better nutrition, better health and more for all.

## FOOD RETAILING AND ECONOMIC GROWTH

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I WOULD like to discuss the "dynamics of food retailing" as it applies to the low-income countries of the world. As a means of accelerating the economic growth of the underdeveloped areas, we have seen the federal government give increased encouragement to investment abroad by private firms and individuals in the U. S. Private U. S. capital has been flowing abroad in recent years, especially into petroleum production. I would like to discuss the possibility that we may see within the next ten years a marked increase in the amount of U. S. investment in food retailing in these low-income areas.

The pattern of U. S. direct investment abroad appears to be shifting significantly. As of 1950, 44% of this country's direct investment holdings in foreign countries other than Canada and the western European states were invested in petroleum and mining and smelting; 15% of our direct investment in these countries was in transportation, communications and public utilities; 13% in manufacturing; 8% in agriculture and but 4% in trade.<sup>1</sup> Let me repeat: but 4% in trade. The striking fact is that in 1950, however, 15% of U. S. net capital movements were accounted for by investment in trade. In other words, the trade sector's share of the *increment* in our direct investment in these areas was much greater than that sector's share of the total U. S. direct investment holdings as of 1950. This would seem to support the hypothesis that private U. S. capital is being attracted increasingly into the trade sector of the low-income countries.

A few preliminary remarks about these data are in order. First, I do not mean to imply that most, or even much, of this investment in the trade sector is represented by food retailing. About 70% of the trade sector investment is accounted for by wholesaling and another 25% by retailing. Secondly, some of the 1950 net investment in trade was surely a result of the Korean War inventory build-up, but presumably a similar inventory investment occurred in other industries and so did not distort unduly the relative importance of the trade sector investment. It should also be pointed out that the trade sector's greater share of investment in 1950 was due in part to net disinvestment in two of the sectors, namely: agriculture and transportation, communications and public utilities. Finally, it might be mentioned parenthetically, that since the capital coefficient is lower, i.e., the capital turnover is higher in trade than in the extractive industries and in manufacturing generally, the relative significance of our

<sup>1</sup> *Foreign Investment in the United States*, a supplement to the *Survey of Current Business*, U. S. Department of Commerce, 1953, Appendix Table 4, p. 44.

investment in the trade sectors of low-income countries would be even greater if the amount of sales, rather than the amount of investment, were compared.

This statistical impression of increasing U. S. investment in the trade sector of the low-income countries is supported by knowledge of the experience of various U. S. firms, Sears-Roebuck providing perhaps the best known example.

I would like to discuss the possible reasons for this apparent shift of our foreign investment toward retailing and wholesaling and to ask especially whether we can expect more U. S. capital to be attracted into food retailing in these low-income areas.

The historical attraction of private U. S. capital into petroleum, mining and smelting abroad is readily understandable. Much of this investment resulted from the search of U. S. companies for cheap and reliable sources of raw material supplies. Under such circumstances, of course, there was no problem of finding a market for the output. Furthermore, the almost certain long-run increase in the U. S. demand for minerals was an impelling force, and in many cases the low-income countries were happy to have their natural resources developed by foreign capital. The virtual absence of import duties on raw materials also facilitated the sale of minerals on the world market.

The historical importance of transportation, communications and public utilities sector as an overseas outlet for U. S. investment funds can be explained in several ways. Frequently some investment in railways, harbors and other shipping facilities was a prerequisite to mineral exploitation. Furthermore, since the transportation facilities were selling a service largely to domestic buyers there were no trade barrier problems. Perhaps of greater significance is the fact that railroads historically in most low-income countries have been in a position to cash in on economic growth. In recent years, however, private U. S. funds have been extruded, as it were, from this sector by nationalization or by government control approaching nationalization.

Why is a smaller proportion of U. S. direct investment abroad routed into the manufacturing and agricultural sectors? First of all, in some individual countries, such as Cuba, there *has* been considerable U. S. direct investment in agricultural production for export, perhaps because large-scale production methods are appropriate and the product can be readily marketed in the U. S. More frequently the agricultural sector produces primarily for the local market and U. S. capital is reluctant to invest. U. S. investment funds move abroad only when the marketing channel for the commodity to be produced is reasonably clear and unobstructed.

Unfortunately for the economic development of the low-income countries, private U. S. capital is far less interested in manufacturing operations than in mineral exploitation even though the former is held up, somewhat erroneously, as the *sine qua non* of development. Unlike agriculture, the manufacturing sector as an investment opportunity frequently is as unpopular with the local people as it is with foreigners. In large measure the development of manufacturing is retarded in underdeveloped areas because of market and marketing problems. International trade barriers restrict the movement of manufactured goods far more than the movement of raw materials; the limited size of the local market frequently makes mass production, as the industrialized countries of the western world know it, impossible without an assured export market. Commonly the problem of obtaining an adequate and satisfactorily skilled labor force is a strong deterrent. In an underdeveloped economy also a manufacturer may miss the service industries that facilitate and lower the cost of factory production in mature industrial communities. In contrast with the manufacturing sector, we may see the trade sector account for an increased share of private U. S. investment funds flowing abroad. These funds may be attracted especially into food retailing and the retailing of other basic consumer goods. Several reasons can be cited for this expectation. First, in many low-income areas the income per capita is rising, expanding the purchasing power of the average family. Furthermore, the population increases are serving to increase the size of the market. In Latin America, for example, the population has been growing since 1920 at about twice the world rate. So the market is broadening both in terms of number of people and purchasing power per person. Insofar as economic growth is associated with industrialization and consequent urbanization, the concentration of population established a context attractive to modern retailing. The tariff barriers that shackle development of manufacturing in low-income areas are not as serious for retailing and wholesaling, since the "product" here is a service for sale on the domestic market. Furthermore, the distributor in any of the underdeveloped areas is a good bit more flexible than the manufacturer who attempts to establish there. It is more difficult for the manufacturer than for the distributor to shift from one good to another. Also the problem of recruiting the sort of labor required is probably not as great in trade as in manufacturing operation.

But more important, retailing in general but food retailing in particular in low-income areas is notably inefficient, as a rule. I have just published an attempt to measure the extent of this excess capacity in the case of Puerto Rico by estimating the cost functions of food retailers and whole-

salers.<sup>2</sup> There it was found that really striking economies can be effected by the reduction of excess capacity in food retailing. It seems that the current average return over cost of 23% could feasibly be reduced to about 12%. That there is room for such improvements in food retailing is testified to by the experience of the Rockefeller International Basic Economy Corporation in Venezuela and of certain firms in Puerto Rico. The Rockefeller IBEC investment history, as a matter of fact, would seem to support the notion that opportunity for successful investment in food retailing in the low-income areas is considerably greater, relative to the other sectors, than has generally been appreciated. It is now reported that IBEC will concentrate its efforts on food processing and distribution rather than industrial production.

Finally, the food retailing sector of certain low-income areas would seem to provide attractive investment opportunities for U. S. firms because successful investment in this area requires not capital as much as knowledge of and experience with the managerial techniques necessary for mass distribution. By these techniques I mean, of course, the single price policy, the large-scale buying, vertical and horizontal integration, intense price competition and the high volume, low price policy which characterize present-day food retailing in the U. S.

We know that local consumers would be responsive to such retailing methods. Again the IBEC experience can be cited as well as that of certain low-margin food retailers in Puerto Rico. Low-income people are apparently as price conscious as one would expect. A significant proportion of them welcome the opportunity to buy for less by foregoing some services. A few years ago I studied a sample of consumers in a Massachusetts town and there the price consciousness of the low-income people stood out very clearly. It would seem that we can generalize to say that poor people are price conscious, wherever they are. If this is true, our mass distribution techniques would seem to be quite saleable in the low-income areas of the world.

In sum, then, I am suggesting that in a low-income area we might find it easier to invest in mass distribution before we invest in mass production because fewer obstacles lie in the way of investment in distribution.

Having set forth this hypothesis with such confidence, I must conclude with a few of the many qualifications that should be stressed. First, the food retailing innovation in the low-income countries will probably not be characterized by the giant super market as we know it. Some of the

<sup>2</sup> John Kenneth Galbraith and Richard H. Holton in collaboration with C. S. Bell, R. E. Bronson and J. A. Robinson, *Marketing Efficiency in Puerto Rico*, Harvard University Press, 1955.

major cities may warrant a few scaled-down super markets, but the great need is for chains of the old "pine board" grocery stores, selling the basic necessities at a minimum mark-up. Incomes are simply not high enough to support a modern U. S. super market with the usual wide selection of items. The low automobile population requires that the chain outlet be relatively small.

Secondly, efficient distribution of food may appear after integrated distribution has been established for other basic consumer goods. Clothing, shoes, and simple home furnishings in some respects offer fewer distribution problems than does food and may attract integrated distribution before food distribution does.

Thirdly, the big difficulty lies in the training of managerial personnel. But experience gained here in the U. S. can be applied to this problem, and the general desire on the part of young men abroad to learn U. S. managerial methods would seem to prevent this obstacle from becoming too great.

Fourthly, U. S. distributors may well refuse to look to these low-income areas as possible investment outlets until the current boom in shopping centers and super markets slows down. It is always simpler to expand in relatively well known territory than to establish stores of a different sort in an unknown market area.

Also, it might be mentioned that rationalization of food distribution may not be an unmixed blessing for the country in question. Presumably many high-margin retailers would be driven out of business and would add to what is typically a chronic unemployment problem. Also the demand stimulation resulting from the development of an aggressive distribution system may increase the demand for imports and create or intensify a balance-of-trade problem. But the risk might be worth taking. Certainly the great bulk of the population would enjoy the lower food costs and therefore higher real income. Also the development of a stronger distributive system can facilitate the production of local goods by removing some of the difficulties of marketing. The impact of more economical food distribution would seem quite clearly to redound to the great benefit of the typical underdeveloped area in the long run.

## A CRITIQUE OF FEDERAL STATISTICAL SERIES: INDEX OF CONSUMER PRICES\*

Chairman: Frederick F. Stephan, Princeton University

### WHAT CONCEPTS ARE APPROPRIATE TO CONSUMER PRICE INDEXES?

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THE topic assigned to me is already well represented in the literature, but it has hardly been exhausted. We cannot yet point to a consistent, well rounded, really relevant, and widely accepted theory of consumer price indexes. And even if we could, occasional excursions into the fundamentals of economic measurement would still be as essential as the pilgrimages to the original shrines of the world's great religions. For such excursions enrich understanding, provide a surer basis for evaluating what has been accomplished, and regenerate zeal for pursuing what still lies outside the grasp. Indeed, they should encourage the makers and users of economic statistics not only to ask for "more," like Samuel Gompers and Oliver Twist, but also to ask for "better."

#### I

At the outset of such a paper, some remarks seem necessary on the nature of concepts, measurement, and index numbers. These remarks would be superfluous if my position on the multiplicity and arbitrary character of index numbers were generally accepted and strongly maintained by the makers and users of consumer price data and other economic measures.

In general, three classes of concepts—three kinds of meaning—should be distinguished. One of these, *operational*, still receives more attention than the other two as fresh successes of the physical sciences give new force to the teachings of Bridgman and the logical empiricists. Operationalism stresses the dependence of meaning upon measurement. It may even insist upon the identity of the two. But the importance of *preoperational* (Carnap's "prescientific") meaning—of the tentative, primitive, intuitive, commonsense, incompletely defined concepts that we seek to quantify—must also be acknowledged. For all their fuzz of connotation, such concepts should not be disparaged; they serve as vehicles of thought

\* Joint session of the American Farm Economic Association and the American Statistical Association.

\*\* The opinions expressed here should not be attributed to the organizations with which the author is associated.

and communication for the expert as well as the layman. Finally, we must recognize that a measure itself has an ulterior, a *transoperational*, meaning. That is, the details of a measure define a pseudo-preoperational universe that, even for one time period, is a mere caricature of the original "real" universe. An economic measure that compares different points in time also implies a theory of relevant change that appears progressively more arbitrary, more inconsistent with the true historical process.

I like to think that the above remarks already provide a logical foundation for the observations I shall now make on the nature of index numbers. First, many plausible index representations are conceivable for a preoperational concept that is not specified in detail. Second, none of these plausible indexes is inherently superior to any other without reference to a particular context or use. In other words, the designation of any index as "best" should have a pragmatic, rather than dogmatic, basis. A unique measure is indicated only if the preoperational concept is stated so specifically that it permits but one operational (algebraic) formulation. Third, no single index is satisfactory for all concepts and uses. Fourth, all indexes are artifices, having a conventional character that should not be ignored. For example, they typically juxtapose data, like quantity weights and prices, wrenched out of original and natural settings. They imply an aggregative theory of valuation and interperiod comparison that is strictly incompatible with the traditional theory of individual economic choice—with the traditional theory concerning a well defined decision maker having a fixed preference map and inconstant marginal rates of substitution along given indifference curves.

## II

What does all this mean for consumer price index numbers? The most important implication is that numerous measures, appropriate to different purposes, are definable; that, if complete ideal data were available and funds were unlimited, the discriminating statistician or his client ought to suit the measure to the problem. Many index numbers should accordingly be generated. Specific deflators should be constructed. No single measure should be established as the standard "general purpose" index, canonized as "best" without reference to a problem. Empirically, it might be decided, of course, that certain refinements are not worth the time and trouble to make, so that one measure may serve as proxy for another. But it would not be wise to make such decisions once for all. Indeed, experience shows that, in periods of significant structural change or stress—at the turning points of business cycles, in transitions from peace to war or war to peace, in times of shortage and hoarding—even the layman may become wary of substitute measures. The man in the street—especially the

one wearing a blue collar—may suddenly learn the difference between Tweedledum and Tweedledee and turn on the expert who once tried in vain to tell him this difference. Ample documentation is supplied by the recent history of not only the Bureau of Labor Statistics "cost of living" index but also the BLS productivity indexes for manufacturing.

Several sources of the diversity of conceivable consumer price measures might be noted. One is the choice of the *reference group*. Thus, a measure need not refer to all farm families or to the families of urban wage earners and salaried clerical workers. It might refer instead to rural or urban families in a particular high-income or low-income bracket, in a given percentile range of the income distribution. Or it might refer to a particular family or individual at different points in time, thus reflecting not only price changes but the impact of income changes, etc., on the pattern of consumption. Or it might refer to a family or individual believed to be comparable in level of living to a base-period prototype.<sup>1</sup>

Multiple choices are also possible with respect to the *criterion of comparability*, the range and homogeneity of *commodities* and services purchased, the completeness of *income* representation, *geographic coverage*, and type of trade *outlet*. Thus, if ideal data were available, we might wish to compare the prices of living at the same level of "welfare," whatever the assortment of purchases, instead of the prices of a given "market basket." We might wish to have either categorical or comprehensive measures; and, for studies of elasticity of demand and intermodity competition, we might wish to separate fresh and frozen foods, butter and other spreads, clothing made of natural and synthetic fibers, etc. We might include or exclude *income taxes*<sup>2</sup> and make alternative assumptions regarding the disposition of savings. We might wish to differentiate cities by size and location; or organize data on prices paid by farmers according to type and size of farm, location, and major product. We might wish to distinguish department stores from discount houses, corner grocery stores from super markets, etc.

Then, of course, there are choices to be made with respect to certain technical details of measurement. These important operational features are generally not specified in a preoperational concept, although ideally they should be. I refer particularly to the choice of the *unit* for which a

<sup>1</sup> Note that a time comparison for a particular family or a comparison of two equivalent families would not, like the BLS temporal measure for "average" families, normally include, in any single aggregate, expenditures for *both* home acquisition and rental, coal and electricity, electric refrigeration and ice, etc. In a measure for a particular individual or compared equivalent individuals, the budget would not include *both* men's and women's oxfords, girdles and diapers, etc. Similar remarks are applicable to indexes of prices paid by farm dwellers.

<sup>2</sup> See "Taxes and the Consumers' Price Index," *Monthly Labor Review*, January 1953, pp. 53-57.

commodity is priced, the index-number *formula*, and the *weights*; and to the strategy of adjusting for gaps in reporting, for quality alterations, and for changes in the universe of commodities and services.

Before proceeding to the next section of this paper, I should like to give even more definiteness to my position by citing two viewpoints contrary to my own. These examples are chosen in the interest of clarification and without any desire to disrupt the tranquility of this Yule season. At the 1952 session of the American Statistical Association on consumer price indexes, R. A. Sayre took exception to Mrs. Laura Webb's proposal that budget data be collected in different areas to reflect the impact of price changes on expenditures of comparable families. According to Mr. Sayre, intercity and interoccupational comparisons might be a "hindrance" because wage adjustment is perhaps "*the main use*" of the consumer price index and "one good statistic in this field is far better than several meaning different things."<sup>3</sup> I should regard the ascendancy of this viewpoint as most unfortunate. As for the second illustration, I have already gone on record elsewhere as disagreeing with Professor Mudgett's designation of a chain index as "best," as superior in principle to a fixed-weight, fixed-base aggregative index.<sup>4</sup> Although I, too, should welcome the annual collection of corresponding price and quantity data, I insist on the multiplicity of conceivably useful formulas and procedures. Although I, too, have employed the chain index conventionally to maintain the semblance of historical continuity, I am impressed with the weaknesses exposed by G. H. Knibbs and W. I. King; and I have additional reasons to doubt the sense of this sort of index.

### III

Despite the variety of conceivable measures, we find only a small number of consumer price indexes holding the field. This situation is, of course, a common one. The most comprehensive government measures are the BLS index of prices paid by urban wage earners and salaried clerical workers and the Agricultural Marketing Service index of prices paid by farmers for family living. BLS and AMS also show indexes for component categories, and BLS publishes series for 20 of the 46 cities for which it compiles data. The National Industrial Conference Board, a private organization, publishes consumer price indexes for twice as many cities as BLS. Not until 1955 did BLS show separate price figures for commodities other than foods and fuels.<sup>5</sup>

<sup>3</sup> R. A. Sayre, "An Appraisal of Some New Features in the Revised CPI," *Monthly Labor Review*, February 1953, pp. 174-75.

<sup>4</sup> Review by I. H. Siegel of B. D. Mudgett, *Index Numbers*, in *Journal of Economic History*, Winter 1952, pp. 69-71.

<sup>5</sup> *Average Retail Prices: Collection and Calculation Techniques and Problems*, U. S. Department of Labor Bulletin No. 1182, June 1955.

Many reasons may be given for the paucity of consumer price indexes. Not the least important, of course, is the cost of compiling and processing the required data. Another is the enshrinement of "official" government indexes in legislation (especially with reference to agriculture)<sup>6</sup> and in contracts (especially between labor and management). Furthermore, once an index exists, it tends to acquire new uses, and it becomes the vehicle of many, even conflicting, interests. Finally, we must not overlook such reasons as custom, inertia, philosophical monism, and a cheerful belief in the inherent simplicity of things.

Practically, what should the statistical pluralist and purist do? He would be ill advised to say "the struggle naught availeth." He must continue to point to the difference between the measures we *do* make and use and those we *should* make and use; to provide analytical clarification of this difference;<sup>7</sup> and, where possible, to study cases revealing empirically the magnitude and direction of this difference. He must also recognize and take advantage of the opportunities that exist for experimentation and improvement within the established programs of the departments of Labor and Agriculture. Surely, the present session was designed to encourage "outsiders" to suggest alternative concepts and procedures; and reports and hearings amply attest to the interest of the Executive branch and the Congress in ways to improve price statistics.<sup>8</sup>

#### IV

The remainder of this paper indicates plausible routes for makers, users, and students of consumer price indexes toward the twin objectives of "more and better." In my earlier remarks on the sources of diversity of conceivable indexes, I noted some of the alternative concepts that may have practical interest. I mention some of these alternatives here again, in addition to others.

The BLS consumer price statistics program requires expansion in at least two directions. First, the geographic coverage of the compiled data should be enlarged, and indexes should be published for more communities and areas. Several factors already favor such development: the return

<sup>6</sup> See the appendix on "The Parity Concept and Its Relation to the Farm Problem" in M. R. Benedict, *Can We Solve the Farm Problem?*, New York: The Twentieth Century Fund, 1955, pp. 532-53.

<sup>7</sup> See, for example, articles by I. H. Siegel in *Journal of the American Statistical Association*, 1941-43, on the use of correlation, matrix, and vector methods in studying index-number inequalities.

<sup>8</sup> Among the recent evidences of this interest are: the paragraphs on the BLS and AMS measures in a special appendix on the needs of Federal statistical programs in *The Budget of the United States Government for the Fiscal Year Ending June 30, 1956*, p. 1203; the 1954 inquiry into the adequacy of Federal statistics by the Joint Committee on the Economic Report; and the 1951 hearings of a Special Subcommittee of the House Committee on Education and Labor, leading to the report, *Consumers' Price Index*.

of the concept of decentralization to a place of political and social respectability; the drive of rural states for balanced economies; the federal concern for chronically distressed communities; and the steady diffusion of population into the suburbs and beyond. Second, BLS or some other agency should make indexes for urban groups in addition to wage earners' and salaried workers' families. The coverage of groups having higher and lower incomes is desirable for numerous administrative, legal, and research purposes. A broader price index is clearly needed, for example, for the more satisfactory deflation of consumer expenditure and personal income.

The AMS indexes of prices paid by farmers and their families also require improvement in various respects. Other speakers note the desirability of increasing the range of goods and services covered and of pricing items according to specifications. I wish to call attention to two other needs. One is the regionalization of the indexes to reveal geographic differences in trend. The other is the computation of specific parity indexes and parity ratios from data pertaining to each of the major crops. One can only speculate on the course price-support policy might have taken since 1933 if such subnational indexes had been available.

The development of comprehensive urban-rural consumer price indexes would represent another forward step, providing more relevant deflators for consumer expenditures and personal income. Mrs. Webb has on earlier occasions suggested the combination of BLS and AMS data, at relatively little additional cost, into a national measure of retail prices.<sup>9</sup> Attention should be called to the recent brave effort of A. Hurwitz and C. P. Stallings to derive 1929-53 urban-rural price deflators for state per capita income payments from BLS, AMS, NICB, and other data.<sup>10</sup>

The striking rise of home-mortgage and installment debt points to a needed change in both the BLS and AMS indexes. Instead of pricing homes, automobiles, refrigerators, washing machines, furniture, etc. as physical wholes, we should reckon their cost on the time basis on which they are purchased. Thus, the relevant prices are generally not the quoted total prices but downpayments, periodic interest and amortization payments, delinquency penalties, and costs incident to default. A home purchase should be treated on virtually the same basis as a rental. New contracts and continuing debt have to be distinguished.<sup>11</sup>

<sup>9</sup> *Monthly Labor Review*, February 1953, pp. 173-74; and Staff Memorandum No. 2, on "The Adequacy of Price Indexes," included in the Bureau of the Budget materials presented at the July 12, 1954 hearing of the Subcommittee on Economic Statistics of the Joint Committee on the Economic Report.

<sup>10</sup> "Interregional Differentials in Per Capita Real Income Change," a paper prepared for the June 17-18, 1955 Regional Income Conference on Research in Income and Wealth.

<sup>11</sup> According to the position taken here, the BLS item "sales price of homes" would apply only to the few homes purchased outright; and the "mortgage interest rate"

Several other useful projects come to mind. It has recently been suggested that a separate, properly weighted price deflator should be constructed for purchases by consumers with funds withdrawn from savings, since such withdrawals are allocated much differently from current income.<sup>12</sup> Another need is a weighted national index of wage rates, for use in the derivation of an urban-worker parity ratio analogous to that computed for farmers. (A true wage-rate index—representing "prices" received by urban workers—would have occupational weights and also distinguish between straight-time and overtime hours.) Still another need is the inclusion of off-farm pay "rates" and other omitted compensation for services in the prices-received index, for the computation of the farmers parity ratio. Another welcome addition would be the reckoning and publication of dollar-cost series for specific urban and rural family budgets.

I have saved for last some comments on price measurement over periods marked by significant changes in technology, tastes, variety of consumed goods and services, and quality (both deterioration and improvement). Such changes introduce discontinuities that no index formula, chain or any other, can convincingly repair. By mincing a period of upheaval into small intervals, we neither capture the essence of, nor nullify the impact of, the events that shaped the period as a whole. An explosion occurs even if we can arrange to see it stroboscopically; and an arrow still flies even if, like Zeno, we break up time into a sequence of infinitesimal steps.

Being skeptical about chain indexes and not being squeamish about admitting the arbitrary character of all indexes, I suggest that experimentation with what I have called the "free composition" index formula would illuminate both theory and practice.<sup>13</sup> Indeed, I regard the chain index as a crude approximation, at best, to a free composition measure, which directly faces the problems of discontinuity and obliges the statistician to make explicit assumptions.

The free composition index is the logical extension of the conventional aggregative index (e.g., Laspeyres, Paasche, Edgeworth, or multiyear-weighted). It refers to the "same" comprehensive matrix of products for all years. Some of these products have zero quantity in some years (i.e.,

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would apply only to newly assumed mortgages. Similarly, the items "automobiles, new" and "automobiles, used" would be limited to outright automobile purchases.

<sup>12</sup> J. B. Lansing and S. B. Withey, "Consumer Anticipations: Their Use in Forecasting Consumer Behavior," in *Short-Term Economic Forecasting* (Studies in Income and Wealth, Volume 17), published by the Princeton University Press for the National Bureau of Economic Research, 1955, pp. 391-92.

<sup>13</sup> See I. H. Siegel, *Concepts and Measurement of Production and Productivity*, Washington, 1952, pp. 70-74; and "Aspects of Productivity Measurement and Meaning," in G. Deurinck, ed., *Productivity Measurement, I: Concepts*, Paris, 1955, pp. 49-50, 56.

before or after their economic lifetimes) and hence require fictitious corresponding sales prices. In principle, these prices should be the lowest ones consistent with zero sales and with the observed price-quantity configuration for all other items.<sup>14</sup>

In closing, I want to state that both BLS and AMS deserve to be complimented on, and ought to be encouraged to extend, their traditional policies of revealing the technical details of their indexes, of disclosing various weaknesses, and of warning against certain misuses. The maintenance and strengthening of such policies can only stimulate confidence in, and gain support for improvement of, their statistical wares.

<sup>14</sup> Some hypothetical prices may be estimated by reference to available domestic or foreign substitutes. For products not yet technologically feasible, no unique generally acceptable criterion may be offered.

Incidentally, a Laspeyres free composition price index with an early base period avoids some of the problems created by innovation, since it assigns zero weight to products not yet made in the base period. Such an index requires fictitious current prices for products no longer made, but these estimates offer comparatively little trouble. On the other hand, a Paasche free composition price index requires base-period prices for products not yet made in that period.

Note that a free composition index seeks to register the full effect (a) of the relative price declines experienced by new products and (b) of the increased prices for "special orders" of items no longer made in quantity. The chain index incorporates the ridiculous assumption that the prices of items not yet made (or measured) or already defunct move in exactly the same way as the index computed for available products.

## THE PARITY INDEX AND THE FARM EXPENDITURE SURVEY

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THE Index of Prices Paid by Farmers for Commodities and Services, including Interest, Taxes, and Wage Rates—frequently referred to as the Parity Index—is one of two principal indexes commonly used to measure price changes in the agricultural sector of the economy. The other is a companion index, the Index of Prices Received by Farmers for commodities sold. The ratio of the latter to the former is called the Parity Ratio, and indicates whether prices farmers are receiving for their products have risen (or fallen) more (or less) since the base period than have the prices farmers pay for the things they buy. The base period is, of course, 1910-14 as defined by law.

The main characteristics of both these indexes are reasonably well known, and information concerning their construction, the collection of the data going into them, the relative importance of the various commodities, and so on, is available in published form. More detailed information is of course available on request to the Agricultural Marketing Service. Certain features of the Parity Index, particularly with respect to the contrast of one of its major components with the Consumer Price Index, will be discussed later on this panel. Consequently, except for certain preliminary remarks, my comments will be directed primarily to some developments now in progress, and with some of the major problems we face in further improving the Parity Index.

The preliminary remarks I wish to make have to do with the general setting of the Parity Index.

As is widely known, the Index consists of five major components:

1. Prices paid by farmers for commodities used for living.
2. Prices paid by farmers for commodities used for production.
3. Interest payments per acre on farm mortgage indebtedness secured by farm real estate.
4. Taxes per acre payable on farm real estate.
5. Farm wage rates.

The first of these is somewhat analogous to the Consumer Price Index. That is, the Consumer Price Index measures changes of prices of goods and services representative of moderate income families—wage earners and clerical workers—whereas the living goods component of the Parity Index measures average price changes of goods and services bought by farmers for use in family living. Thus, both are first approximations (and

only first approximations) to the true Price component of Value Change for their respective universes. By true Price component I mean, of course, the theoretical measure of Price Change—sometimes designated in the literature as  $P_{01}$ —more specifically the ratio expressing prices of one period relative to those of another, which, when multiplied by a similar measure of quantity change—designated  $Q_{01}$ —would account uniquely and completely for the value change of a group of products from one time to another. Any notion of using a price index as a deflator for a value series implicitly assumes this requirement to be satisfied. To the extent that it is not satisfied, the result of the deflation will be spurious. Naturally the similarity in function of the two indexes has led to their comparison, and to the discovery, or at least the recognition, that there are certain differences between them.

For example, the weights assigned to the various components differ, reflecting different expenditure patterns. Rent, for example, is an important element in the expenditures of urban dwellers, whereas for farmers, the house is generally an integral part of the farm establishment, and any effort to identify a rental value of a farm house separate from the farm as a whole reduces to guesswork, since a rental market for such houses is virtually nonexistent.

Again, there are differences in the data collection methods. For the Consumer Price Index, the approach focusses upon individual cities, whereas the living component of the Parity Index necessarily spreads over a much wider territory with the state serving as the basic unit for original price estimating, and the whole U.S. as the only unit for which the official index is published.

Again, the Consumer Price Index is based largely upon prices collected by enumerators who periodically interview a given list of store managers, and secure price quotations. With the respondents concentrated in fairly compact groups, this approach is not only feasible in terms of cost but highly advantageous from virtually every point of view. On the other hand, in the case of the Parity Index, since farmers make purchases in virtually every village and hamlet across the nation, the collection of prices paid by farmers, exclusively or even largely, by personal interview—even assuming a fairly dilute sampling of such places—would impose budgetary and appropriation problems of a formidable—and, in the judgment of some, a prohibitive—character. However, statistically speaking, such an approach of course would be extremely attractive.

The potential gains from the enumerative approach are, of course, much more impressive for certain commodity groups than for others. In several fields, such as food, many clothing items, feed, and fertilizer, the mail approach is doing a generally satisfactory job. But for some others, such as farm machinery, automobiles, and trucks, to name a few,

the mail approach—indeed either the enumerative or any other approach—presents a host of problems that are far from being solved. But more of this later.

Whatever the future may hold as to changed methods of collecting the basic price date, the situation to date is that a mail sample approach to merchants serving farmer populated communities has provided the principal approach to data collection for the Parity Index. We are using a limited amount of personal enumeration and expect to expand such coverage to the extent that it is practicable to do so, but cost considerations present a major obstacle to effectuating any large-scale change.

One other difference between the two indexes has come in for considerable attention—namely the degree to which detailed specifications should be proliferated in questionnaires. We have believed for some time that pricing on the basis of the most commonly bought items within what is classed as a commodity has resulted over the years in a more realistic measure of price change than pricing tied tightly to manufacturers' specifications. This was amply illustrated during the war when items—particularly in the service-grade or low-priced categories—were discontinued and items serving the same general function, but in a higher price range, were substituted. When such changes in merchandising policy occur, particularly when associated with quality deterioration, pricing procedures that are tied to excessively tight specifications seem likely to obscure price movements that are of real economic significance. It will be recalled that this and related subjects came in for detailed study by a committee of the American Statistical Association during the war. The consumer, by trial and error, generally tries to secure the best over-all bargain for a given commodity by shifting his preference from one line to another. Accordingly, it seems that pricing on the basis of the most commonly bought variations for a given commodity will reflect the real price change the farmer has to pay in order to secure a particular commodity or service. It is important to remember that what we are trying to measure is changes in prices farmers pay for goods and services.

One important aspect of this situation is brought into focus most sharply by commodities like automobiles, radios, phonographs, washing machines, for example, where model changes are made every year or oftener, with the result that pricing identical commodities over any extended period is a physical impossibility. As a matter of fact, no one is really interested in what a Model-T Ford would cost today as compared to what it cost when it was in vogue. What people are concerned with from the standpoint of automobile price comparisons is the cost of a Ford, Chevrolet, or Plymouth today in relation to the cost of its counterpart last year, or 5 years, or 25 years ago. Or, they may ask for a comparison of some of the

prices of medium price cars now with their counterparts in an earlier day; and similarly for the higher priced lines. Such comparisons are quite legitimate, irrespective of the fact that the cars of today differ from those of yesterday in appearance and riding qualities. Indeed, they provide the only meaningful comparison that is possible in such fields. What is really significant, from the standpoint of automotive prices, is the change in cost of the means of transportation at the different relative levels of comfort, convenience, or luxury over the years, and not the change in price of a particular mechanical design or configuration of steel, rubber, and chrome. It seems clear that it is in this area that the impact of a dynamic economy with constantly shifting specifications, new techniques, changes in design, and scientifically exploited market stratification collides most sharply with the static measures based on the concept of rigid specifications. This phase of the subject has many ramifications and in my judgment the time is ripe for a broad gauge re-examination of the whole subject.

The above are not all the differences between the two indexes; they are some of the more important, and I mention them for the record and as a basis for my next statement. Interesting as the comparison may be of the similarities and differences between the Consumer Price Index and the Living Goods component of the Parity Index, there is another comparison that is less widely recognized, but is of far greater importance.

I refer to the fact that the Parity Index and the Index of Prices Received by Farmers are companion indexes. That is, they measure complementary magnitudes appertaining to a single economic group, namely, farmers. Moreover, they are both involved—under legislative provisions—in the computation of parity prices for farm products. Thus it seems to me that the "fraternal associations" which are of overriding importance are those involving the Parity Index and the Index of Prices Received by Farmers, rather than those involving a single segment of the Parity Index on the one hand and the Consumer Price Index on the other.

In the 1950 revisions, we provided as nearly as practicable similar structure and concept for the Parity Index and the Index of Prices Received.

The impact of the Parity Index upon the economic structure is of a vastly different character than in the case of the Consumer Price Index. The impact of the Parity Index is through its effect upon parity prices, purchase and loan programs, and marketing agreements. That of the Consumer Price Index is through direct contractual relationships established through collective bargaining. I emphasize again therefore that the comparisons of primary concern are those involving the Parity Index and the Index of Prices Received rather than those involving the Consumer Price Index and one section of the Parity Index.

With these preliminary remarks out of the way, I want to discuss briefly a major development now in progress and to mention one of the really difficult problems in the field of price collection.

The 1950 revision of the Parity Index used weights considered to reflect farm expenditure patterns during 1937-41. For the Living component of the index these were based on two surveys, one near each end of that period. At that time the need for recurrent review of the weighting pattern was recognized. The report of the committee of the Bureau of Agricultural Economics that was responsible for the 1950 revision said

"... it is strongly recommended that investigations be planned now to secure data which can be used as a basis for weights for the index of prices paid for a suitable postwar period."<sup>1</sup>

There are, however, "many slips twixt the cup and the lip," and it was not until the current year that resources became available with which to undertake a survey to collect the basic data necessary for such reweighting. This objective, together with that of estimating net farm income by regions, instead of only for the U.S. as heretofore, is expected to be realized from a nationwide survey planned for February and early March of 1956. The survey is being conducted as a joint operation of the Bureau of the Census and of the Agricultural Marketing Service. The target was 10,000 completed schedules from farm families, showing in considerable detail their expenditures by commodities and commodity groups during the calendar year 1955.

Since a complete questionnaire on both living and production expenditures would require interviews averaging at least 5 to 6 hours in length and impose a too great burden on respondents, the questionnaire was divided into two parts, one relating to living expenditures and the other to production expenditures. This decision was reached after consideration of alternative plans, a review of other experience in this general field, and some experimentation in a pretest of the questionnaire in two areas.

The living vs. production break seems a natural one, and has the merit that it permits the allocation of the sample within counties by economic class on an optimum basis for both questionnaires. The optimum allocation by economic class of farm for production expenditures differs from the optimum for living expenditures.

According to the 1950 Census of Agriculture, two-thirds of the farms accounted for 97.5% of the value of products sold by all farms; and 25% of the farms accounted for 75% of value of products sold. Since expenditures for production purposes are highly correlated with value of products sold, obviously it would be a very inefficient use of resources to spend

<sup>1</sup> "The Revised Price Indexes," B. R. Stauber, N. M. Koffsky, C. Kyle Randall, *Agricultural Economics Research*, April 1950, Vol. II, #2.

much effort collecting production expenditures on the one-third of the farms that accounted for only 2.5% of the value of sales. Accordingly, farms were divided into three groups. The first contained economic classes 1 and 2 as defined by the Census; the second comprised economic classes 3, 4, and 5; and the third comprised economic class 6 and "other farms." For the production schedule, the sample allocation to these three groups within primary sampling units is closer to the proportionate value of sales for the three groups than to the proportionate number of farms. For the living expense part of the survey, the correlation of living expenditures with value of products sold is rather lower than for production expenditures. Accordingly, an allocation of sample farms among the three economic groups somewhat more nearly proportionate to number of farms than to value of sales was adopted as providing an efficient sample.

Also, inasmuch as the data on living expenditures only enter into the Parity Index and are therefore required only on a national basis, whereas production expenditures are required on a regional basis, it was concluded that the over-all allocation for the U.S. would be 4,000 questionnaires on living expenditures and 6,000 on production expenditures with the same ratio in each region.

The sample design is that of a two-stage stratified random sample; that is, primary sampling units (generally a county) were selected with probability proportional to size within strata, and individual farms within the primary sampling unit were selected randomly within each of the three major economic groups.

As a first step, the total 10,000 sample was allocated among 8 major geographical areas, which, except for the combination of the New England and Middle Atlantic groups and the inclusion of Maryland and Delaware with this North Atlantic group, are the customary Census geographic groups. This regional allocation was made giving consideration to number of farms, value of products sold, and the general variability of agriculture and type of farming within regions.

Within each region, counties were grouped into strata, in such a manner that, as nearly as possible, (1) each stratum should be uniform internally in terms of type of agriculture, and (2) each stratum should be the same "size," with "size" defined in a special sense to be indicated in a moment.

The measure of "size" of county and of strata was derived from the number of farms in the county by multiplying the number of farms in each of the three economic classes by the over-all sampling rate for that class, and summing for the county.

Very small counties were combined, so that each primary sampling unit would provide about 40 to 50 sample farms, which is estimated as about a month's work for an average interviewer. One primary sampling

unit was selected from each stratum with probability proportional to size.

In certain southern states where research work on crop estimating methodology already under way had already resulted in the selection of a group of sample counties, this group of counties was used for the expenditure survey instead of drawing a separate group. This group was selected by a probability procedure somewhat different in detail, but essentially equivalent in over-all result, to that which I have described.

The individual farms were preselected on a probability basis, using the sampling rates already mentioned for the three economic groups, from the names of farmers from the 1954 Census of Agriculture. Such a list selection permits greater sampling efficiency than alternative approaches, such as area sampling, and a pretest in two areas indicated rather good success in locating the predesignated farms in the field. Field work is scheduled for the month of February and should be completed in most areas by early March.

Besides supplying data for revising the weights for the Parity Index and for strengthening the estimates of net farm income, the results should provide a basis for many related analyses, such as the relation of income to consumption in the farm population for many items besides food. They should provide material of considerable interest also to market analysts.

Once the results of the survey have been summarized, the problems of the actual revision of the Parity Index can be taken up. Without attempting a catalog of these problems, a few problems are inescapable.

The base period is set by law, and the weight period is largely conditioned by the availability of survey data. Beyond these comes the question of commodity coverage.

The major fields of farm expenditures that have not as yet been incorporated into the Parity Index are:

1. Medical, dental, and hospital expenditures.
2. Farm rental payments.
3. Insurance—life, accident, fire, property, liability, etc.
4. Custom rates for various types of services, such as harvesting certain crops; machine hire; and repair work on autos, trucks, and tractors, which are not represented adequately by the farm wage rate component of the Parity Index.

Another set of problems has to do with improved commodity coverage in areas already represented in the Parity Index. As of the present, about 350 commodities are included. Every expansion of coverage means added expense in the current processing of the price data, so that the improvement that comes with more complete coverage must be weighed against the increased cost and the availability of resources for the job.

The present Parity Index includes 46 food items, but no frozen foods. The use of such food is growing fast, and doubtless will be shown to be

important in rural areas. Collection of prices of a limited list of frozen foods is scheduled to begin in 1956 in preparation for the next revision of the index.

The clothing group already includes a reasonably representative list, as is true for a number of other groups. On the other hand, some groups are represented by a very small list of commodities, and need to be expanded. Insecticides and containers are perhaps the most critical, although constant revision and appraisal is needed all across the board to keep the index content on a realistic basis.

The new data concerning expenditures will be of great assistance in arriving at decisions concerning these problems, and in indicating the direction that subsequent price collection work should take.

Another question has to do with commodity grouping. Currently, the Parity Index combines 17 subgroups, each published as a separate index. There is some demand for still further fractioning. For example, we have been asked to break out farm tractors as a separate group, and some have urged that we transfer them from the motor vehicle group to the farm machinery group. Quite possibly other similar requests will come to light. In any event, these proposals will all have to be reviewed, the pros and cons considered, and decisions reached.

A discussion of price indexes would not be complete without at least some reference to the really serious problems involved in collecting prices. However, time permits mention of only one.

This one is probably the most thorny problem in the whole field of basic price collection, namely that of securing the actual prices at which commodities in the administered price field pass to the consumer. As far as farmers are concerned, the more serious problems of this type are in the field of autos, trucks, and farm machinery, although the activity of the discount houses in the consumer goods field has not been limited wholly to urban centers.

Many of us here can recall how consumers, during the war and early postwar years, paid substantial premiums to secure durable goods in short supply, such as autos and farm machinery. Similarly, the last year or two has seen the reverse situation, wherein dealers have been offering substantial discounts from list prices, with or without trade-ins. This has led some to question whether the available indexes fully reflected the extent to which these premiums and bonuses increased current levels of prices actually paid in transactions during the postwar period, and whether the indexes now fully reflect the reductions resulting from recent allowances and discounts.

We have been queried by persons both in and out of the trade as to whether the discounts that are commonly believed to exist in the auto-

motive and farm machinery field are reflected—or reflected fully—in our indexes. I can only answer that we try to uncover both the premiums and discounts in our inquiries to dealers, but we have a strong feeling that reported data lean toward recommended selling prices, rather than being absolutely clean actual prices with all discounts and premiums fully reflected.

In this area the price collector is in a quandary. Prying into an area that many business men consider an extremely private matter, he finds himself with a "Hooper rating" that at best is somewhere between that of the tax collector and the undertaker, and more likely below both. The very nature of these businesses renders it difficult to get the pricing of transactions down generally to a basis comparable, say, to that provided by grocery stores where the prices are labelled on the shelves for any and all to read. Recording of prices of autos, trucks, and tractors from actual sales documents would provide the ideal solution, but very few dealers are willing to open their books to the price collector to this extent. Yet business men in these same fields are aware of the real situation, and raise a critical eye if the indexes for their field do not reflect such discounts.

Our efforts in this area of pricing have met with only limited success, but our best results have been secured by personal contact, as has been possible to a limited extent. Probably the ultimate answer, to the extent that an answer is found, will come from several directions. One of these will no doubt be the increasing use of personal contact with dealers to the extent that resources permit. This facilitates the collection process by giving assurance that the information secured is the information desired; and by promoting confidence in the price collector on the part of the dealer to the effect that data furnished will be protected and not divulged to a competitor, nor to the tax collector, nor to those who have the power to cancel a franchise. But the answer also involves a broader realization throughout the business community that the understanding and interpretation of economic events generally is helped rather than hindered by the reporting of real prices, instead of list prices or recommended prices in situations where the actual market has gone off in a different direction. In this field, professional statisticians can exert a very wholesome influence by promoting a wider acceptance of the fact that all elements in the economic community have an interest in making the various economic indicators as accurate as possible.

In any event my personal observation leads me to believe that this area of pricing is probably the number one trouble spot at the present time and that, aside from keeping weighting patterns reasonably current, increasing effort in this area will pay bigger dividends in terms of more dependable indexes than similar efforts in any other area of pricing activity.

## BLS CONSUMERS' PRICE INDEX AND THE AMS INDEX OF PRICES PAID BY FARMERS FOR FAMILY LIVING—A JUXTAPOSITION

LAZARE TEPER

*International Ladies' Garment Workers' Union*

IT IS only natural that in a desire to evaluate changes in the purchasing power of farmers and of wage and salaried workers, resort should be made to the two price-deflator series published respectively by the Agricultural Marketing Service and the Bureau of Labor Statistics. Not infrequently the two series are assumed by their users to be quasi-homogeneous and this in turn tends to provoke controversy when the movements of the two indexes digress.

It is proposed in this paper to examine a few selected basic characteristics of the two indexes. It is hoped that by contrasting their frameworks of reference, the techniques used in their compilation and the approaches used by their compilers to measure price changes that a better understanding of the two series may be attained. It is also hoped that the insights obtained from such analysis will be of help in the evaluation of the two series.

At the outset, note should be taken of the fact that in describing what each of the two series tends to measure, their compilers rely on substantially similar language. BLS speaks of its Consumers' Price Index as a measure of the "average change in retail prices of goods, rents, and services customarily purchased by city wage-earner and clerical worker families."<sup>1</sup> In a similar vein, AMS refers to its Index of Prices Paid by Farmers, Including Interest, Taxes and Farm Wage Rates (known, for short, as the Parity Index) as a measure of "changes in the prices of goods and services bought by farm families for use in living and production."<sup>2</sup> The Index of Prices Paid by Farmers for Family Living is, of course, one of the five subindexes of the Parity Index. Specifically, the latter is defined as measuring "average changes in prices paid by farmers on a nation-wide basis for consumers' goods."<sup>3</sup> These definitions thus make it appear as though BLS and AMS consumer price series seek to measure the same thing—the average changes in retail prices paid, although by two different segments of the American population.

Even if the methodology and techniques used to measure price movements were identical in the case of the BLS and the AMS series, some

<sup>1</sup> U. S. Bureau of Labor Statistics Bulletin No. 1165: *Consumer Prices in the United States, 1949-52*, p. 15.

<sup>2</sup> U. S. Agricultural Marketing Service, *Agricultural Prices*, October 15, 1955, p. 34.

<sup>3</sup> *Ibid.*, p. 35.

divergence in their behavior should be expected inasmuch as functionally they reflect the changing costs of different consumption patterns. Life on the farm differs from that in urban communities and this alone affects both the quantity and quality of the different goods and services consumed. To the extent, therefore, that each of the two indexes portrays the changing cost of a different "basket" of goods and services, some differences in their movements are unavoidable.

An additional factor accountable for the difference in the two series arises from the fact that urban wage and salaried workers purchase virtually all the items they consume, while farmers do not. The two latest available surveys of farm consumption expenditures, though somewhat outdated, illustrate this fact. Thus, in the 1935-36 period, only 40 per cent of food consumed on the farm was purchased;<sup>4</sup> in 1941, purchased food accounted for 42 per cent of consumption.<sup>5</sup> A somewhat similar problem is presented by housing. Typically, only the cost of repairs and insurance on the family farm home is treated as an expenditure ascribed to the cost of living on the farm. All other expenditures for the farm home are treated as a farm business expenditure.<sup>6</sup> Thus, the housing cost for farmers is deemed to be primarily a noncash item; this, of course, is not the case with the urban dweller.

To the extent that both the workers' and farmers' consumer price series are used as deflators of their respective incomes for the evaluation of changes in their respective welfare, a question can properly be posed regarding the propriety of such usage in the case of the Index of Prices Paid by Farmers for Family Living. On the face of it, the reply must be negative. Just as the total income of farmers consists of cash realized from the sale of farm produce and of goods produced for personal consumption, so the appropriate price deflator should relate to total consumption, i.e., to goods and services both purchased as well as those produced for personal consumption (including the appropriate allocation of the total expenditures for living quarters). The task is not impossible. Regular estimates are now prepared for the total economic income of farmers and this requires the estimation of the worth of home consumption and rental value of farm dwellings, including the assignment of appropriate price quotations to production for home consumption.<sup>7</sup> The same approach can

<sup>4</sup> U. S. National Resources Planning Board, *Family Expenditures in the United States: Statistical Tables and Appendices*, p. 13.

<sup>5</sup> U. S. Bureau of Labor Statistics Bulletin No. 822, *Family Spending and Saving in Wartime*, p. 75.

<sup>6</sup> Cf. U. S. Department of Agriculture Miscellaneous Publication No. 520, *Rural Family Spending and Saving in Wartime*, p. 30, fn. 4.

<sup>7</sup> U. S. Department of Agricultural Miscellaneous Publication No. 703, *The Agricultural Estimating and Reporting Services of the United States Department of Agriculture*, pp. 145ff.

be utilized in computing the weights for home consumption and in assigning valuations to the items consumed. Logically, in the calculation of the noncash sector of income and expenditures, price quotations for identical items should be identical—in effect, the equivalent transaction represents the disposal of home produced items to one's self instead of selling them in the open market at prevailing prices received at the time for similar goods. Thus, the equivalent consumer price index for farmers which would relate to total consumption would have to be composed in part of goods and services purchased at retail and computed in terms of prices paid by farmers and in part of items disposed to one's self at wholesale, i.e., at prices then received for similar items.

The limitations of the present-day method in compiling consumer price indexes for farm population by confining them to those items for which cash outlays are made are well known, as is the fact that the limitation of such an index to items requiring cash outlays makes it difficult to compare the changing welfare of the farm group with that of other segments of the population.<sup>8</sup> Differences in the completeness of the consumption patterns reflected by the BLS and AMS consumer price series is, however, but one of the several distinguishing characteristics between them.

One of the more obvious differences between the two series is the choice of periods and the methods used in developing their respective weighting diagrams. Both indexes were revised within the recent past, the AMS series in 1950 and BLS one in 1952. AMS in developing its revisions was confronted with a lack of comparatively recent farm expenditure surveys, and a lack of appropriations to undertake them. Accordingly, with the full recognition of the outdated character of the data, it relied on the farm expenditure surveys for the 1935-36 period and for 1941. The data provided by these two surveys was averaged,<sup>9</sup> and the resultant figures were ascribed to the 1937-41 period.<sup>10</sup> They were then utilized to develop the average amounts of total expenditures for the major sub-groups of the index. BLS had the advantage, in revising its index, of having a more recent expenditure survey conducted in 97 representative cities throughout the nation for the year 1950. In developing index weights, however, the Bureau projected the 1950 expenditure data to a later date, variably described in BLS publications as 1952,<sup>11</sup> January

<sup>8</sup> Cf. International Labour Office, *Cost-of-Living Statistics: Methods and Techniques for the Post-War Period* (Report prepared for the Sixth International Conference of Labour Statisticians), p. 16.

<sup>9</sup> Unpublished information supplied to the author.

<sup>10</sup> B. Ralph Stauber, Nathan M. Koffsky and C. Kyle Randall, "The Revised Price Indexes," *Agricultural Economics Research*, April 1950, p. 52. This paper, as well as some unpublished material on the AMS index were used as the primary sources of information about it.

<sup>11</sup> U. S. Bureau of Labor Statistics Bulletin No. 1165, p. 23.

1952,<sup>12</sup> or the fiscal year 1951-52.<sup>13</sup> For this purpose, the Bureau adjusted the survey data for unusually high purchase of automobiles, TV sets and other consumer durable goods in 1950 as well as for price and income changes that had occurred after the survey year.

The imputation of weights to an alleged pattern of consumption as of a date different from the one for which the original data on consumption expenditures were collected, however justified, should have been accompanied with the publication of technical information to enable interested students to make independent evaluations of the procedures. This would seem to be a sound statistical practice. However, this was not done. We know, in a generalized way, what computation BLS undertook to prepare its weighting diagrams for the revised Consumers' Price Index. But we have no basis for knowing why food expenditures between 1950 and 1952 were adjusted solely for the changes in prices although it was likely that as a result of the abnormal level of purchases of durable goods in 1950, food consumption might have been out of line with the long-term trend.<sup>14</sup> Nor do we know why AMS, after combining the 1935-36 and the 1941 expenditure data, reached a conclusion that the resultant figures represent weights for the average expenditures in the five year 1937-1941 period rather than the average of the seven year 1935-1941 period. Similarly baffling is the claim made by AMS that the major groups of farm family expenditures covered by its index of prices paid for family living, account for \$734 out of the total expenditure of \$742 spent per farm family for living purposes.<sup>15</sup> This contention makes it appear that all components of family living except for those represented by an annual expense of \$8 are accounted for by the index. However, when one turns to the available descriptions of this series, we find that medical costs are not represented in the index,<sup>16</sup> and they amounted to \$21 a year in the 1935-36 period and to \$26 in 1941.<sup>17</sup> Whatever the reason for this discrepancy, the issue obviously cannot be resolved in the absence of the much needed technical information on the procedural and computational aspects of the index.

The estimation of consumer expenditure patterns provides the index makers with much of the needed benchmark material. Thereafter, how-

<sup>12</sup> U. S. Bureau of Labor Statistics Bulletin No. 1140, *The Consumer Price Index: A Layman's Guide*, p. 5.

<sup>13</sup> U. S. Bureau of Labor Statistics Bulletin No. 1168, *Techniques of Preparing Major BLS Statistical Series*, p. 65.

<sup>14</sup> Cf. Lazare Teper, "An Evaluation of the Revised CPI as a Wage Deflator," *Monthly Labor Review*, February 1953, p. 171.

<sup>15</sup> Stauber, et al., *supra*, p. 52.

<sup>16</sup> *Ibid.*, p. 40.

<sup>17</sup> National Resources Planning Board, *supra*, p. 13; Department of Agriculture Miscellaneous Publication No. 520, p. 26.

ever, decisions must be made as to what specific items are to be priced and regarding the weights to be imputed to them. BLS and AMS handling of this problem differs materially. In its revision, AMS relied on the expanded collection of price quotations which it undertook over a period of years, presumably on an ad hoc basis; no published rationale for the choice of items to be priced seems to be available. By the end of 1949, AMS had on hand some 60 series for the different food items, 75 series for clothing and so on. On an implicit assumption that the index comprising all the available price series would be most representative, indexes for food and clothing were computed for 1942 and 1948, with June 1939 taken as 100, composed of all the available data and using the individual commodity weights for the specific items without imputation for any of the absent commodities. Additional indexes covering these three dates were constructed by excluding those items which accounted respectively for less than  $\frac{1}{2}$ , 1 and 2 per cent of the particular group expenditure. By comparing the latter indexes with the reference series, it has been decided that the exclusion of items which accounted for less than one-half per cent of group expenditures did not appreciably affect the levels of the group index, and, accordingly, except for minor inclusions or exclusions of a few commodities near the cut-off point (made on recommendation of staff specialists), the choice of individual commodities for inclusion in the revised index was thus determined. Quantity weights for individual commodities were then computed by dividing the expenditures imputed to the particular item by the average price paid for it by farmers in the five year 1937-41 period.

AMS thus made no specific tests to determine whether there was a basis for the specific imputations except to satisfy itself that the deviations between the indexes for subgroups of commodities utilizing all the available price series and those which excluded the items accounting for less than one-half per cent of the group expenditures were smaller than the deviations of such subgroups from the group index based on all the available price series.<sup>18</sup> This is obviously a somewhat primitive test. AMS did, however, recognize the limitations of such a system of imputation. No imputation, for example, was made in the case of medical care (in effect, its weight was imputed to the Index of Prices Paid for Living as a whole). And yet, the review of the data of the two expenditure surveys and the items included in the revised Index suggest that apparently some extreme and probably unwarranted cases of imputation did take place. Thus, the only item reflecting expenditures for personal care included in the index is toilet soap, reading expenditures are represented

<sup>18</sup> Stauber et al., *supra.*, p. 45f.

solely by newspapers, and recreation costs by radio sets and radio-phonograph combinations. A somewhat different procedure seems to have been used in developing price series which make up the housing component of the index—in their case the appropriate weights were imputed to the cost of building materials for a house, which in turn were estimated from data on farm expenditures for all building materials.

By comparison with the procedures used by the AMS, the techniques used by the BLS seem much more advanced.<sup>19</sup> The 1950 consumer expenditures survey did provide information on the extent of purchases of different goods and services, in what quantities and at what prices. To establish, however, what items were to be included in the index for regular pricing, field investigations were undertaken to discover what items exhibited similar price behavior in the past and which, therefore, might be assumed to continue to behave similarly in the immediate future. The identification of such "price families" was used for assigning group weights to the specific items chosen for regular pricing, usually on the basis of its comparative importance in the group. BLS approach in identifying "price families" thus has an apparent advantage over the technique used by AMS in that it was not restricted in its choice of items to be priced. In consequence, the inclusion of the different goods and services in the BLS index appears to be on examination much more representative of the consumption patterns of wage and salaried workers than the AMS index can claim in the case of farmers.

The identification of items to be priced by BLS brings to the fore another basic difference in its methodology from that used by AMS. Aside from identifying the specific items to represent a given "price family," BLS, by means of a parallel investigation of prices reportedly paid by consumers in the period covered by the expenditure surveys sought to isolate that point or points in the price scale for a specific broad class of items at which the largest number of purchases were actually made. Thereafter, it attempted to relate the particular price level to the appropriate descriptive quality definition. Such specifications, descriptive of the physical and other basic characteristics of the chosen item, were designed to cover a limited range of items typical of the quality level associated with the particular price in a way to enable the identification of the particular item for pricing purposes in the different retail outlets and at different periods of time and yet without making such descriptions unduly rigid so as to hamper the continuity of subsequent price collections.

<sup>19</sup> For the description of the BLS approach to the selection of items to be priced for the Consumers' Price Index, see Bulletin No. 1182, *Average Retail Prices: Collection and Calculation Techniques and Problems*.

On the other hand, AMS typically prefers to define the items for which it seeks to obtain price quotations on a much broader basis than does BLS. Individual commodities are described in a way suitable to identify broad generic classes of goods, such as "Dinner Plates, plain," "Living Room Suites, 2-piece upholstered," or "Women's nightgowns, cotton," and price quotations are typically sought from retail outlets for kinds of such items which are "most commonly sold to farmers," a method which may be referred to as volume-seller pricing.

The difference in the two approaches to pricing is basic. On the one hand, BLS seeks to determine the comparatively narrow class of items which is commonly purchased by the group with which it is concerned. Thereafter, within the confines of a specification for the particular item—one that is not unduly rigid and is not unduly loose—it seeks to continue pricing the particular item over a period of time. In this fashion BLS hopes to isolate, to the greatest extent possible, the movement of prices of a given item influenced *de minimis* by major changes in its specifications over a period of time or by shifts in consumer purchases to goods of the same generic description or end-use but of different specifications. Thus, in a sense, it would appear that BLS is striving toward the measurement of what may be called "pure" price changes, although this ideal is virtually impossible of attainment particularly in a highly industrialized, high-level economy in which manufactured goods tend to become ever complex and ever changing. And admittedly, in specific cases BLS must recognize this fact and depart from strict specification pricing when goods change radically as between models of one year and another, as in the case of automobiles, or when specifications are impossible to develop, as in the case of some services.

On the other hand, AMS proceeds on the assumption that price quotations it secures must be influenced not only by changes in prices for identical items over a period of time, but also by shifts in consumer buying as between goods of different specifications. This is done in the belief that price quotations obtained for the most popular items, which fall in a particular generic class of goods, tend to reflect most accurately the real price changes paid by the consumer to secure the satisfaction of his wants. This approach to measurement of price change is also justified on the ground that prices received by farmers for the goods they sell, as compiled by AMS, reflect not only changes in prices but also the mixture of the different grades and qualities as well; and therefore, it is argued that "conceptually" the method of measuring prices paid by farmers should be the same as in the case of prices received by them for the proper appraisal of the economic position of the farmer. It is obvious, however, that a positive correlation is likely to take place between the movements of the two series so constructed. Thus, when prices received

by farmers are high and their purchasing power is improved, they are likely to shift their buying to goods of better quality and hence higher in price. The parity ratios, under these conditions, are not prone to reflect fully the improvement in the farmers' status because of uptrading. Similarly, at the time when farm prices decline and farm incomes shrink, forcing farmers to shift their purchases to goods of lower grades, the resultant parity ratios are not apt to reflect fully the degree of deterioration in the farmers' position because of downtrading. Elsewhere, it has been suggested that "the mere advance of farm incomes, if it affects qualities bought, may raise the parity index even though no price changes for industrial items have occurred," and that "to this degree the index is not a welfare measure, but it structurally more indicative of farmers' ability to buy at existing prices those goods which they choose to buy than is the Consumers' Price Index with reference to urban worker's incomes."<sup>20</sup>

Parenthetically, it may be noted that the ideal price quotation for a given generic class of items in a given period, as conceived by AMS, is one that could be computed by taking the total sum of money spent in their acquisition and dividing it by the number of items purchased. The nearest approach to this figure is deemed to be the average of quotations obtained from individual retail outlets for the kind of items most commonly sold there. In effect, AMS thus suggests that a mean of modal price quotations would approximate the mean of all price quotations at which a particular group of items falling in the same generic class was sold. This assumption is, at best, questionable, in the face of a realization that the distribution of price quotations for a given generic class of items is prone to be skewed. This is obvious, for example, in the case of available data on prices paid by farm families for the different items of clothing,<sup>21</sup> from data on similar expenditures made by urban families,<sup>22</sup> as well as from the available statistics on the wholesale prices at which the different items of clothing are sold.<sup>23</sup> Even if it is found that the standard deviation and the probable error of the mean for a sample of modal price quotations is comparatively small, it is questionable whether the resultant mean of modal quotations necessarily approximates the mean of all individual price quotations—concentration of modal values around a point of

<sup>20</sup> Richard B. Heflebower, "An Economic Appraisal of Price Measures," *Journal of the American Statistical Association*, December 1951, p. 478.

<sup>21</sup> Cf. U. S. Department of Agriculture Miscellaneous Publication No. 428, *Family Expenditures for Clothing*, pp. 114f.

<sup>22</sup> Cf. U. S. Bureau of Labor Statistics Bulletin No. 1182, pp. 9f.; also communication to the author from Mr. Abner Hurwitz, of the Bureau of Labor Statistics, November 15, 1955.

<sup>23</sup> Cf. U. S. Bureau of the Census, Facts for Industry Series M67H-03, *Women's, Misses' and Juniors' Outerwear*, 1953, pp. 6ff.

central tendency is possible despite substantial skewness of the basic data.

The dispute regarding the superiority of two approaches to pricing is not new. Originally BLS relied on volume-seller pricing. However, following a series of studies carried on in conjunction with the Federal Inter-departmental Committee on Retail Prices, BLS adopted specification pricing in November 1934<sup>24</sup> in the apparent desire to measure price changes to the exclusion of other collateral influences. On the other hand, the devotees of volume-seller pricing apparently persist in their defense of this method in the hope that the resultant indexes will prove to be more sensitive to the shift of consumption to goods of better quality with rises in incomes, inasmuch as the indexes so constructed do contain "a built-in relative gain" factor<sup>25</sup> for the group to which they apply.

It is quite possible that the decided preference for volume-seller pricing on the part of AMS is a subconscious by-product of expediency. To this day, AMS continues to rely for the bulk of the price quotations it obtains on mail questionnaires. These are disseminated to independent stores through the regional offices of AMS on a quarterly basis, and to chain stores directly from Washington on a monthly schedule.<sup>26</sup> Admittedly, this method of price collection cannot be used if the respondents have to adhere to comparatively precise product specifications for their reporting. The imperfection of this method of pricing is apparent in more ways than one, even with the system in use. Thus it has been found by AMS that pricing of automobiles by mail yielded poor results. It was thus necessary to depart from volume pricing in favor of data for the specific makes and models. Even then, the mail reporting did not prove altogether satisfactory due to the failure of many reporters to include in the price quotations the freight and handling charges incurred between the factory and the dealer's showroom as well as the prices of accessories. As a result, AMS began to supplement its mail inquiries with field enumerations in 12 states; these were, however, limited to the cities where field offices were located and occasionally to nearby towns. Similar checks were found to be needed in the case of items such as living room suites where variability in price reporting was found to be excessive in view of the highly heterogeneous nature of the product.

Collection of quotations by mail creates other problems. There is a considerable shift in respondents from one pricing period to another. The rate of nonresponse is high, ranging from about 50 to 90 per cent

<sup>24</sup> U. S. Bureau of Labor Statistics Bulletin No. 1182, p. 4.

<sup>25</sup> Heflebower, *supra.*, p. 478. Cf. also Arthur G. Peterson, "Agricultural Price Index Numbers," *Journal of the American Statistical Association*, December 1947, pp. 600f.

<sup>26</sup> Data on electric and telephone rates are collected annually by a special mail inquiry addressed to farmers, while local newspaper rates are tabulated annually from secondary sources.

with food retailers approximating a nonresponse rate of about 70 per cent and clothing stores of around 60 per cent. Mailing lists must, therefore, be amended continually. Regional personnel is advised, however, to avoid overloading of mailing lists with new names in order not to influence returns by a disproportionate showing by new respondents. While it is hoped to obtain price quotations from all areas where farmers trade, no data on family living items is collected, as a matter of policy, from any city where BLS also collects price data.

The problem of price variations, which exists even on the individual state basis, is also bothersome. Regional office personnel are therefore admonished to sample most heavily those districts within their regions that show considerable variations in the reported quotations. Generally, they are urged to secure about 25 returns for each of the subregional pricing districts in the hope that sampling error would thus be kept down to 0.5 per cent at the 95 per cent confidence level. It is not generally known to what extent this objective is carried out. It is obvious, however, that it cannot be maintained. Thus, for example, in September 1949, while 2869 quotations were received throughout the country for coffee, only 1259 quotations were obtained for living room suites and only 336 for Chevrolets. In part, of course, the difference in the number of obtainable quotations depends on the relative density of outlets selling the particular commodities.

The imperfections of the reporting mechanism forces AMS to utilize data gathered from its respondents as a basis for subsequent estimations by its state statisticians as well as by the representatives of the Crop Reporting Board of the Department of Agriculture. Thus, a state statistician, after examining the returns and the computed averages, is expected to check it on the basis of his own knowledge of price developments supplemented by information from newspaper ads, catalogues and price lists and then formulate his own "recommendation" of the proper average price quotation. While typically it may be the same as the reported average, it does not have to be and in some instances is not. Similarly, when the particular state "recommendations" and computed averages are sent to Washington (original data are retained on the local level), representatives of the Crop Reporting Board may in turn substitute their own "recommendations" as the best estimates of average price quotations for specific categories of goods in the individual states. The national averages are computed by weighting individual state estimates of price quotations obtained from independent and chain stores by the estimates of relative importance of the sales volume for each type of outlet. A different weighting structure is used, however, in the months when price data are not collected from independent stores; weights are

then limited solely to the relative importance of chain store business. The national averages so computed are then used in the calculation of the overall indexes.

The haphazard sampling procedures forced upon AMS by its usage of mail reporting techniques is in sharp contrast to the sampling design used by BLS, developed through "a system of stratification and clustering to make the collection of data and calculation of indexes as efficient . . . as possible, with a minimal sacrifice of precision."<sup>22</sup> Pricing for the Consumers' Price Index is done predominantly by trained field agents who visit retail outlets and have the opportunity to examine the items for which they secure price quotations to insure comparability over a period of time.<sup>23</sup>

The sample of 46 cities where BLS gathers price information was selected by the "Latin Square" technique after stratifying all cities of the United States into four groups by size, and within each group by climate, population density per square mile and average income. In the case of the smallest cities, the distance to markets was used as an additional criterion for stratification. In this way, BLS hoped to obtain a city sample which could be deemed typical of the nation's urban communities. In the case of food and rentals, probability sampling procedures were then used to select pricing outlets. However in the case of other goods and services, the choice of outlets where prices were to be sampled were based on judgment rather than probability techniques. An attempt was nevertheless made to choose representative outlets as to size, type of operation, quality of goods sold or of services rendered, location, and clientele. Pricing of food, fuel, rents, nonfood grocery items and group hospitalization is undertaken monthly in all cities. Otherwise, only five cities are priced every month. The remaining cities are priced on a rotation schedule, every three months in the 25 large and medium-size cities and every four months in the 16 smaller ones. Prices of houses and rates such as for fire and auto insurance and mortgage interest are gathered, however, either annually or bi-annually on a rotation cycle.

In carrying on pricing activities, BLS agents are expected, whenever possible, to inspect the merchandise they are pricing in order to minimize

<sup>22</sup> Edward D. Hollander, "The Revised CPI: Some Problems in Concept and Theory," *Monthly Labor Review*, February 1953, p. 168.

<sup>23</sup> Rent information is obtained monthly by mail; however a bi-annual check on such reporting is made through personal visits by field agents. Prices are also collected by mail in the case of a few large retail organizations that operate stores in many cities and in the case of some commodities distributed through manufacturers' retail outlets. In the latter case, reporting is periodically checked by personal visit. In addition, price collection by mail is undertaken in the case of street car, bus and rail fares, public utility rates, newspapers, fuel and a few additional items, such as automobile insurance, for which prices change infrequently. In the case of items such as postage, electric rates and the like, price data are taken from government records. In the case of smaller cities, some data are also taken from mail order catalogs.

possible errors in the application of specifications and to insure comparability. When a particular item is not available or is found unacceptable for pricing, another article that satisfies the same specification may be taken, in which case the difference in the price between the original item in the last pricing period and the substitute one is treated as a price change in the calculation of the index. However, when substitution has to be made by an article serving the same end-use but described by a different specification, relative changes in the prices for the new article are "linked in" in order to prevent any differential in prices which may be due to the differences in quality between the old and the substitute item from affecting the movement of the index. Except for prices charged in the course of special sales of short duration, the reported quotations are supposed to represent the actual prices charged. However, if a given item is temporarily out of stock but is expected to be back by the next pricing, BLS accepts the price last reported as that for the current pricing period.

Processing of data gathered in the field is carried on by BLS in Washington. Price quotations for specific items are averaged for each city, compared with averages for the same items in the preceding pricing periods, and relative changes are computed. In the case of food, reports from chain stores are weighted by the relative importance of sales of the individual chain stores; thereafter, data for chain and independent stores are combined on the basis of their relative importance. In the case of other items, however, no such weighting is undertaken. Individual price relatives are weighted by "value weights" representing the cost of the weight-period quantities at prices prevailing in the preceding pricing period. In this fashion, indexes for specific groups of goods and services as well as for all items combined are calculated for each city. A national index is then computed by weighting each city by its wage and clerical worker population as shown by the 1950 Census. When prices are not collected in a given city, its price changes are imputed to the movements observed in the five largest cities priced every month, with the exception of a few items whose prices do not change frequently and which are kept constant between pricings. Whatever estimating errors are thus introduced, the errors tend to be rectified in the subsequent pricing cycle in the given city when price changes are computed in relation to the previous pricing period.

The present review of the techniques of price measurement used by AMS and BLS is far from comprehensive but merely touches on some of their highlights. Complete appraisal of the merits of the two series, for that matter, is impossible without much of the technical data about the two series that have not seen the light of publication. The juxtaposition of the two approaches in index construction leaves, however, a definite impression that whatever imperfections there may be in the BLS techniques,

and there are many,<sup>29</sup> that agency has forged ahead of AMS in its techniques.

AMS, of course, recognizes some of the deficiencies of its series, particularly in its need to obtain more recent data on the changes in the pattern of farm expenditures.<sup>30</sup> On the other hand there seems to be an inadequate recognition of the need to review the comparatively inefficient pricing methods, and to re-examine the basic concepts implicit in the volume-pricing techniques. In part, this is due to its belief in the representative character of the currently obtained estimates of average prices paid. This confidence was bolstered by the 1950 study made by the Institute of Statistics of the University of North Carolina of agricultural price statistics in that state, which found that although there was an apparent bias in the AMS price estimates it was small and fairly consistent over a period of time.<sup>31</sup> This study, however, had to use the concepts of pricing and commodity specifications developed by AMS. This factor, and the comparatively short period over which the investigation was spread, do not assure the definitiveness of its conclusions.

The existence of disparate approaches to consumer price measurement exhibited by AMS and BLS unavoidably invites a certain amount of confusion among the users of the data. Should two different standards and philosophies guide the measurement of prices paid by farmers and workers? Are those differences justified on scientific grounds or are they merely a reflection of a political tug of war?<sup>32</sup> The issues must be resolved. It is indeed a challenge to the Office of Statistical Standards, the Joint Committee on Economic Report as well as to students outside the government.

<sup>29</sup> Cf. U. S. Bureau of Labor Statistics Bulletin No. 1168, pp. 69ff.; Laura Mae Webb, "The New CPI and the Need for a Continued Price-Research Program," *Monthly Labor Review*, February 1953, pp. 172ff.; Teper, *supra*.

<sup>30</sup> Stauber et al., *supra*, p. 62.

<sup>31</sup> F. E. McVay and Henry Tucker, *A Study of Agricultural Price Statistics in North Carolina* (Institute of Statistics Mimeo. Series No. 42), p. 206.

<sup>32</sup> Cf. Peterson, *supra*, pp. 602ff.

## DISCUSSION: THE NEED FOR AN EXPANDED PRICE RESEARCH PROGRAM

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I agree with Mr. Siegel that we need more measures of changes in consumer prices—measures that are tailored to meet specific uses. The position of importance that the current indexes occupy in determination of public policy, and the uses to which they are put by private in-

<sup>1</sup> The opinions expressed are those of the writer and not necessarily those of the Bureau of the Budget.

dustry and research organizations, place a responsibility on the producers to re-examine periodically the concepts on which the indexes are based, and to be in constant search for means of improving the indexes as measures of the economic phenomena they are endeavoring to measure. Regardless of how accurately these indexes may be developed as measures of the average changes in prices affecting large segments of the population, the indexes may be quite inaccurate as measures of changes affecting special groups. Producers of the consumer price indexes are to be commended for the progress they have made in recent years in publishing the limitations of indexes in application to specialized uses. I hope that progress will be made in the next few years in developing measures appropriate for the more important of these specialized uses. The collection of data for consumer price indexes is a very expensive undertaking. Since much of the data that would be needed for specialized uses are already available from the collection program for the basic indexes, the cost of the additional measures should be relatively moderate. Furthermore, for the majority of uses, frequent compilation would not be required; publication of annual rather than quarterly or monthly data would suffice.

Many specialized uses would be best served, I believe, by dollar measures based upon explicitly stated budgets with adjustments for differences in housing available in the various areas, and for differences in demand occasioned by climatic requirements and regional preferences. Such a measure is more easily understood by the public than the conventionally weighted consumer price index, and does not conceal differences in costs occasioned by differences in levels of living in various areas. The data would provide not only a measure of differences in price levels among geographic areas and city-size groups, but would also provide a tool for evaluating the effect of various techniques that may be used for measuring price changes. For example, if dollar totals showed substantial differences from one year to another as a result of changes in prices for durable goods typically purchased by means of installment credit (e.g., houses, automobiles, washing machines, TV's), this might lead compilers of the statistics to experiment with various techniques to determine which techniques provide the most reasonable answers in terms of stated concepts. Mr. Siegel has suggested a technique that has not been used; that is, to have current "prices" represent both down payments on new purchases and installment payments being made currently on purchases of previous periods. The computation of dollar measures by both AMS and BLS might focus attention on the effect of the differences in pricing techniques used by the two agencies. For example, the BLS index of retail prices for electricity, based upon changes in costs for fixed quantities of electricity, has been increasing steadily since 1947. On the other hand, the AMS index, based on the average price per kilowatt hour paid by farmers, a price that varies with the amount of electricity purchased

currently, has been decreasing during this same period. Estimates of dollar costs would be helpful to technicians in determining approximately how much money consumers have available, after payment for living necessities, for the purchase of luxury goods and for saving. These estimates would also be helpful in evaluating how changes in credit terms, taxes, etc. would affect purchasers by income level.

I agree with Mr. Teper that the method used by BLS in establishing "price families" for the selection of items to be priced in its revised index and in the determination of the imputational pattern for weights of unpriced items has an apparent advantage over the technique used by AMS. However, I am less willing than he apparently is to assume that items that exhibited similar price behavior in the period in which BLS made these tests may be assumed to continue to behave similarly. Or perhaps our disagreement is that I am unwilling to characterize the subsequent five years as the "immediate future" for this purpose. Instead, I believe the study of "price families" should be a part of the continuing research program. I think that it is especially important to repeat the studies on which these decisions were made because the studies had to be conducted during a period characterized by unusual buying situations after the outbreak of hostilities in Korea, and because price controls were in operation during the latter part of the period. Nor do I think that the technique of estimating price changes for those medium and small cities not priced in a given month from the price changes reported in the five largest cities should be discontinued unless the validity of such imputations can be constantly reviewed. BLS has requested funds for pricing a selected list of commodities and services in all 46 cities each month so that the imputation on monthly price changes from the large city sample may be discontinued, and I hope that they are able to make this change.

The AMS will have available, from the expenditure study it is conducting in the spring of 1956, data for evaluating how well the average of quotations obtained from individual retail outlets approximates the average of the prices paid by farmers for many of these commodities. If there are significant differences between the two, I hope that AMS will design an experimental pricing program to determine the causes of these differences and will make whatever modifications are required in sampling and pricing techniques to measure the changes the index purposes to measure. Mr. Teper has suggested three reasons why there may be differences between the two averages: (1) The mean of the modal quotations reported by retailers may not approximate the mean of all the prices at which these retailers sold the commodities to farmers. (2) The stores in the AMS reporting sample may not be representative of retail stores from which farmers made their purchases. (3) Serious error may have been introduced into the AMS measurement by nonresponse. If there are

significant differences between the average prices that farmers reported they paid and those reported by retail stores, I believe that the validity of two assumptions inherent in the pricing technique used by AMS should also be tested. These assumptions are (1) that the retailer can differentiate farmers from his other customers and (2) that of the various qualities of the commodities he has sold, the retailer can determine which quality was "most commonly sold to farmers."

Mr. Stauber's description of some of the problems encountered in determining the actual prices at which commodities in the administered price field pass to the consumer has indicated how important are some of the operational decisions that must be made in compiling indexes of retail prices. I think that both the AMS and BLS are to be congratulated on the experimental pricing programs they are conducting in the field of consumer durable goods. I hope that details of these studies will be published. They should be of considerable interest to students of price statistics.

I hope that Mr. Siegel's suggested "free composition" index designed to avoid discontinuities in statistical series occasioned by changes in types and qualities of consumer goods and services will be the subject of some experimental work. There was certainly need for a statistical technique that would provide a meaningful measure of changes in consumers' expenditures from the era of the washboard, washtub, and clothes line to the era of the automatic washer and drier. There is no reason to believe that there will be less need for the measurement of such phenomenal changes in the future.

I think it is surprising that none of the speakers suggested that consideration should be given to the problem of developing seasonally adjusted consumer price indexes.

Unfortunately during the past few years there has been a reduction, rather an increase, in the number of consumer price indexes available. The AMS index has always been published only on a national basis. I concur with Mr. Siegel that we need this index on a geographic break. An analysis of the new expenditure survey data should determine whether there are differences in the spending patterns for families of tenant farmers and farm owners, and families by type of farm, that would make it desirable to have indexes by these categories, or whether the differences are related for the most part to income level and geographic area. The BLS decreased the number of individual city indexes published from 34 in the mid '30's to 20 at the present time. I am not suggesting that it would be desirable to publish indexes for the individual small cities included in the national sample. An index for a small city when the population makes many of its major purchases in larger cities is not very meaningful to me. Instead, I would prefer to have indexes by city size and

by geographic regions. The discontinuance of the indexes of intercity differences has been a serious loss to the field of price statistics and I hope that the BLS will soon resume computation of the indexes.

Perhaps a revival of interest in price statistics theory and increased attention on the part of the users of price statistics to the conceptual problems relating to the compilation of the statistics would create an effective demand for an expansion of the retail price statistics program.

### DISCUSSION: A CRITIQUE OF FEDERAL STATISTICAL SERIES: INDEX OF CONSUMER PRICES

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Mr. Siegel has, as usual, offered a number of interesting and challenging ideas. In some respects he criticizes our present method of index construction, (e.g., his suggestion that consumers purchases of homes, automobiles, etc., be priced on a time payment basis), while in others he argues that we are trying to make one index serve too many purposes—we need more special indexes. Nevertheless, he is a realist, recognizing the difficulties presented by limitation of resources, the restrictions on changes imposed by the inclusion of existing index series in legislative or contract terms, and the difficulty of educating the users to change.

Siegel notes several particular aspects that should be considered in seeking to diversify our measure of consumer prices. One of these is the *reference group*. The BLS "average" family is a compromise forced by necessity; that is, budget limitations. Our further analyses of the Consumer Expenditure Survey data should provide some of the framework, at least, for future indexes relating to different reference groups. If resources became available, we may be able to develop measures for families of different composition, income levels, occupational status, etc. We are also well aware of the need for place-to-place comparisons of living costs, and we receive many requests for information on a standard budget.

Mr. Teper has criticized us for our failure to provide sufficient technical information on our procedures. My only defense is that we have simply not had the staff time for the completion of adequate technical reports for publication. Some aspects of the methodology of the consumer expenditure survey have been presented by Mrs. Lamale at another session of this meeting. A note on automobile prices appeared in the November issue of the *Monthly Labor Review*. Other technical notes will be published as rapidly as they can be prepared.

Mr. Teper's comparison of the BLS and AMS indexes emphasizes what

he concludes to be a basic difference in methodology and concept between the two indexes with respect to commodity specifications. BLS collects current prices by personal interview (with few exceptions) from officials of stores and service establishments. In pricing to specification, our primary objective is to maintain in the "market basket" approximately the same quantities and qualities of goods as were contained in the expenditure pattern of the typical family in the 1951-52 survey period. Our agents are instructed to report prices on "regular, up-to-date merchandise in saleable quantity." This means that our agents must make substitutions as formerly priced items are replaced in the market by new "volume sellers." If the substitute commodity is of a different quality, its price is "linked in" so that any price differential based on quality change alone will not affect the index.

In his paper, Mr. Stauber may somewhat overemphasize the difference between our two methods. He says "We have believed for some time that pricing on the basis of the most commonly bought items has resulted over the years in a more realistic measure of price change than pricing tied tightly to manufacturers' specifications." Some listeners may infer from this that BLS adheres to rigid specifications, which is not the case, as Mr. Teper has noted. Both AMS and BLS "link in" substitute items in such a way, in theory at least, as to avoid the inclusion in the indexes of significant price changes resulting from quality changes. It is my impression, which is shared by Mr. Teper, that the broad general descriptions used by AMS allow the inclusion in their index of rather substantial price changes resulting from the farmers' tendency to buy higher quality goods when their incomes increase. Mr. Stauber observes that "The consumer, by trial and error, generally tries to secure the best over-all bargain by shifting his preference from one line to another." But I submit that the consumer's conception of a bargain tends to change with changes in his income.

I therefore agree with Mr. Teper that the AMS index, as an element in the establishment of parity prices, tends to generate a spiral. As farmers' incomes rise they buy higher quality goods at higher prices. This raises the index, which in turn leads to a higher parity base, thereby raising farmers' incomes. The converse is true when their incomes start to spiral downward.

In the computation of our Consumer Price Index, we must constantly take account of one of the institutional rigidities to which Mr. Siegel has referred. That is the fact that the index has been included in many labor-management contracts. In this usage the index serves as an instrument for stabilizing the purchasing power of the wage dollar, and should not be affected by changes in buying patterns resulting from changes in the income of workers' families.

# APPLICATION OF MATHEMATICAL PROGRAMMING TO AGRICULTURAL ECONOMIC PROBLEMS\*

Chairman: D. Gale Johnson, University of Chicago

## PROGRAMMING FARM-NONFARM ALLOCATION OF FARM FAMILY RESOURCES\*\*

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### *Introduction*

PART-TIME farming has become a way of life to a large proportion of the farm families in the United States. In 1954, approximately 46 per cent of the farm operators in the United States worked in off-farm employment. An upward trend in off-farm employment of farm people has been apparent for several decades.

The development of part-time farming has not been overlooked by economists. Most studies of part-time farming, however, have been largely descriptive, concentrating on a description of resources on part-time farms and the uses made of these resources. Also, much of the work has been predicated upon the assumption that part-time farming represents an inefficient use of resources. For example, during the 1930's there was a net migration of labor from nonfarm to farm residences. In a series of part-time farming studies conducted during this period, economists emphasized the extent to which part-time farmers competed with "bona-fide" full-time farmers in product and factor markets.<sup>1</sup> During the 1940's and 1950's, the transfer of labor has been from farm to nonfarm employment. In this setting, economists have emphasized the "problem of idle land" created by part-time farming. For example, a recent report asserts that "the part-time farmer makes (apparently) an ineffective use of the nonhuman farm resources and in a sense, prevents anyone else from utilizing these resources."<sup>2</sup> The implication is that the value of the mar-

\* Joint session of the American Farm Economic Association and the Econometric Society.

\*\* Contribution from the Department of Agricultural Economics, North Carolina Agricultural Experiment Station, Raleigh, North Carolina. Published with the approval of the Director of Research as Paper No. 703 of the Journal Series.

\*\*\* In the development of this paper I have benefited from the suggestions of B. Hannush, J. G. Sutherland, and W. D. Toussaint of North Carolina State College.

<sup>1</sup> L. A. Salter, Jr., and L. A. Diehl, "Part-Time Farming Research," *Journal of Farm Economics*, Vol. XXII, No. 3, August 1940, p. 584.

<sup>2</sup> Report of Subcommittee on Appraisal and Planning of Research, Social Science Research Council, Committee on Agricultural Economics, *A Report of the Subcommittee on the Persistence in the United States of Agricultural Areas of Low Income and Low Productivity*.

ginal product of idle land is positive and that part-time farming per se prevents land from being employed in an efficient manner.

In the most general sense, part-time farming is the combination of farm and nonfarm uses in resources controlled by one decision making unit. At any given time, decisions relative to part-time farming involve the principles of choice of products; over time, these decisions are concerned with changes in resource supplies and choice of products. Conceptually, the conditions under which a farm family may be expected to engage in part-time farming are essentially the same as those under which any other use of resources would be selected.<sup>3</sup>

Economists have contended for a long time that the productivity of capital in agriculture is high and the productivity of labor is low in low-income areas in comparison with the productivity of comparable resources in other uses. On the basis of these conclusions, it has been argued that it would be profitable to increase capital investment in agriculture and to transfer labor to nonfarm employment. Although part-time farming is concerned with allocative decisions of a household, and is one way of transferring labor out of agriculture and increasing the amount of capital per man-equivalent of labor in agriculture, little work has been done to appraise economically farm and nonfarm combinations of resources.

The failure of economists to evaluate part-time farming from an economic standpoint stems in part from the lack of satisfactory tools of analysis. Budgetary procedures, as commonly used in farm management, are clumsy tools in the analysis of part-time farming. Single equation models provide little information of value in guiding intrafirm adjustments. On the other hand, programming procedures are especially appropriate for intrafirm analysis. Also, the development of programming procedures has provided economists with a tool that is readily adaptable to part-time farming research. Linear programming has been used in this paper to derive optimal resource use for families on part-time farms with specified resource combinations. An optimal program is developed for a typical part-time farm, and the effects of changes in prices of major commodities and of changes in investment capital are determined.

#### *Optimal Resource Use on a Typical Part-time Farm*

A typical part-time farm from the Southern Piedmont of North Carolina has been selected for an economic evaluation of farm-nonfarm resource allocation. This area is characterized by small farms, and a high proportion of the farm families engage in part-time farming. During 1954, 57 per cent of the farm operators worked off the farm some of the time,

<sup>3</sup>C. E. Bishop, "Part-Time Farming and the Low-Income Farm Problem," *Journal of Farm Economics*, Vol. XXXVII, Proceedings Number, December, 1955.

TABLE I. COEFFICIENTS USED IN PROGRAMMING PART-TIME FARMS, SOUTHERN PIEDMONT AREA, NORTH CAROLINA

Resources		Resources used per unit													
Item	Amt.	Cotton acres	Corn acres	Oats & leg. acres	Alfalfa acres	Barley-milo acres	Sheep 35 ewes	Hogs 5 sows	Fall feeders 1 feeder	Home milk 1 cow	Dairy 8 cows	Home eggs 25 hens	Garden acres	Non-farm work <sup>1</sup>	Rent land acres
Labor (Hrs.)															
Jan.	559	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb.	516	0	0	1.0	0	0	0	0	0	0	0	0	0	0	0
Mar.	600	0.7	1.4	1.0	0	1.0	0	0	0	0	0	0	0	0	0
Apr.	534	1.0	2.3	0	4.0	0	0	0	0	0	0	0	0	0	0
May	669	6.3	2.8	0	4.0	0	0	0	0	0	0	0	0	0	0
June	677	5.6	1.6	2.6	0	0	0	0	0	0	0	0	0	0	0
July	559	1.5	0.8	0	4.0	2.6	0	0	0	0	0	0	0	0	0
Aug.	605	1.0	0	1.4	4.0	1.6	0	0	0	0	0	0	0	0	0
Sept.	650	17.9	0	4.0	1.2	0.8	0	0	0	0	0	0	0	0	0
Oct.	665	39.7	4.0	4.2	0	8.0	0	0	0	0	0	0	0	0	0
Nov.	672	34.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0
Dec.	587	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Land (Acre)															
Cropland	25.5	1	1	1	1	1	1	2.5	1	2	18.5	0	0.5	0	0
Row crops	12.5	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Cotton	6.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Garden	0.5	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0
Cows	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Layers	25.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Invest. capital (Dol.)	4500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net revenue		178.02	\$3.95	47.33	49.31	\$5.08	317.04	482.94	12.60	\$85.39	1308.98	\$2.75	2154.48	406.41	2499.90

<sup>1</sup> One man-equivalent.

and 19 per cent of the farms in the Southern Piedmont were classified as part-time farms.<sup>4</sup>

There are five persons, constituting approximately three and one-fifth man-equivalents of labor, in the family on the typical farm. The quantities of labor and of other resources controlled by the farmer are shown in Table 1. Although the farmer had no savings that he could draw upon in expanding the farm plant and equipment, it was estimated that the amount of investment capital, that could be borrowed on this farm in existing capital markets, was approximately \$4,500. This figure was used as a limitation on investment capital.<sup>5</sup> The farm contained 25.5 acres of cropland and pasture. The physical properties of the soils in this region make them highly susceptible to erosion. In view of this, agronomists do not recommend that more than one-third to one-half of the cropland on a farm be in row crops at any time. Hence, a restriction of 12.5 acres of row crops was imposed on the farm. As cotton is currently limited by production quotas, a 6-acre limitation was placed on acreage of cotton.

Part-time farms are often regarded as a source of subsistence rather than as a source of money income. In the development of the farm plan, therefore, activities carried on primarily from the standpoint of providing subsistence for family members were limited to the scale necessary for subsistence, and the prices of these commodities were established at retail levels. In consultation with home economists, it was estimated that one cow, twenty-five layers, and one-half acre of garden would be required to supply the milk, eggs, and vegetables needed by a family of the composition and size of the one on the typical farm. Thus, these enterprises were limited to the specified levels.

In addition to the subsistence enterprises, processes considered in the analysis were cotton, corn, oats and lespedeza, barley and milo, alfalfa, sheep, hogs, feeder cattle, grade A milk, commercial eggs, nonfarm employment, and a process for renting out land. As part-time farmers often let land remain idle, it was decided to include a process permitting farmers to rent land to others if it paid to do so at a rental rate of \$25 per acre per year, the current cash rent for cropland in the Southern Piedmont.

It is assumed that the operator possesses the technical knowledge of managerial ability needed to produce the specified farm products. As the objective of this paper is to indicate profitable courses of action, the preferences of the operator for particular enterprises are not considered. In programming and implementing farm organizational changes in the

<sup>4</sup> U. S. Census of Agriculture, 1955.

<sup>5</sup> Working capital was not considered as a limiting factor.

TABLE 2. OPTIMUM FARM-NONFARM RESOURCE USE ON A TYPICAL PART-TIME FARM,  
SOUTHERN PIEDMONT, NORTH CAROLINA<sup>A</sup>

Resources	Item	Size of enterprises				Unused resources	Value of additional unit of resource
		Cotton 2.68 acres	Corn 0.89 acres	Oats and lespedeza 11.57 acres	Alfalfa 1.42 acres	Layers 1,089	Nonfarm employ- ment 2.44
Family labor (hrs.)							
Jan.	559	0.0	0.0	0.0	0.0	104.62	379.23
Feb.	516	0.0	0.0	0.0	1.42	117.69	362.10
Mar.	600	1.88	13.75	11.57	0.0	166.93	415.93
Apr.	554	2.68	22.59	0.0	5.70	149.85	379.23
May	669	16.89	97.50	0.0	5.70	117.69	398.80
June	677	15.01	15.71	30.09	0.0	104.62	398.80
July	569	4.02	7.86	0.0	5.70	91.54	379.23
Aug.	603	2.68	0.0	16.20	5.70	91.54	415.93
Sept.	680	47.98	0.0	46.29	1.71	104.62	398.80
Oct.	665	106.42	39.28	48.60	0.0	91.54	379.23
Nov.	672	92.45	55.98	0.0	0.0	91.54	398.80
Dec.	587	1.34	4.91	0.0	0.0	91.54	398.80
Land (acres)							
Cropland	25.5	2.68	9.82	11.57	1.42	0.0	0.0
Row crops	12.5	2.68	9.82	0.0	0.0	0.0	0.0
Cotton allot.	6.0	2.68	0.0	0.0	0.0	0.0	3.32
Garden	0.5	0.0	0.0	0.0	0.0	0.0	0.5
Milk cow	1.0	0.0	0.0	0.0	0.0	0.0	1.0
Layers	25.0	0.0	0.0	0.0	0.0	0.0	25.0
Investment capital	4500	0.0	0.0	0.0	0.0	4500.0	0.0
						0.0	0.07

Parker Branch Watershed in North Carolina, it has been learned that most farmers quickly forget their "preferences" when it becomes known that these conflict with net revenue.

The input-output data used in constructing the budgets were based on point estimates of the output resulting from application of particular levels of inputs. The data were supplied by research workers in the technical production fields at North Carolina State College. Annual average prices during the 1946-52 period were used as a basis for estimating product price relationship. Actual product prices were based on a predicted corn price of \$1.50 per bushel and the price relatives for the period 1946-52. Since factor prices have increased relative to product prices in recent years, 1950-52 factor prices were used.

The net price of labor in nonfarm work was estimated at \$1.30 per man-equivalent hour of work. A large proportion of the farm residents who are employed in nonfarm work are employed in textile mills, and \$1.30 per hour is the average wage of production workers in textile employment in North Carolina.

Production of feed was not considered as a prerequisite to livestock production. Transfer costs of feeds were not considered, and it was assumed that the farmer could buy and sell feeds at the same price. Except for silage and pastures, feeds were produced for use on the farm only if the production of feeds were more profitable than the production of other commodities. Typically, there is no market for silage and pasture in the Southern Piedmont, and the production of these commodities was required if they were used in livestock enterprises.

The level of active processes, the amount of unused resources, and the value of the marginal product of exhausted resources are shown in Table 2 for the typical farm. There are six active processes, but none of the subsistence processes are activated. A high proportion of the family labor is employed. All of the investment capital and land are used; only part of the cotton allotment is used; no land is rented out. The value of the marginal product of land is \$28.51. Hence, if the operator could cash rent land for only \$25 rental per acre per year, it would not pay him to cash rent his land since he could make a higher return at the margin by farming the land himself. The net revenue from this optimum program is \$10,384.

Minor adjustments would be required in this program to make it completely feasible. It is not likely that nonfarm employment can be obtained in fractions of workers. Two and one-half units of nonfarm work, however, represent approximately the man-equivalent units of labor that would be employed if the operator, his son, and one adult female member obtained nonfarm employment.

TABLE 2. OPTIMUM FARM-NONFARM RESOURCE USE ON A TYPICAL PART-TIME FARM,  
SOUTHERN PIEDMONT, NORTH CAROLINA

Resources		Size of enterprises				Unused resources	Value of additional unit of resource
Item	Quantity available	Cotton 2.68 acres	Corn 0.82 acres	Oats and lespediza 11.57 acres	Alfalfa 1.42 acres	Layers 1,089	
Family labor (hrs.)							
Jan.	559	0.0	0.0	0.0	0.0	104.62	379.93
Feb.	516	0.0	0.0	0.0	1.42	117.69	362.10
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Cotton allot.	6.0	2.68	0.0	0.0	0.0	0.0	3.32
Garden	0.5	0.0	0.0	0.0	0.0	0.0	0.5
Milk cow	1.0	0.0	0.0	0.0	0.0	0.0	1.0
Layers	25.0	0.0	0.0	0.0	0.0	0.0	25.0
Investment capital	4,500	0.0	0.0	0.0	0.0	0.0	0.07

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The level of active processes, the amount of unused resources, and the value of the marginal product of exhausted resources are shown in Table 2 for the typical farm. There are six active processes, but none of the subsistence processes are activated. A high proportion of the family labor is employed. All of the investment capital and land are used; only part of the cotton allotment is used; no land is rented out. The value of the marginal product of land is \$28.51. Hence, if the operator could cash rent land for only \$25 rental per acre per year, it would not pay him to cash rent his land since he could make a higher return at the margin by farming the land himself. The net revenue from this optimum program is \$10,384.

Minor adjustments would be required in this program to make it completely feasible. It is not likely that nonfarm employment can be obtained in fractions of workers. Two and one-half units of nonfarm work, however, represent approximately the man-equivalent units of labor that would be employed if the operator, his son, and one adult female member obtained nonfarm employment.

One adjustment in the cropping system also appears desirable. It was assumed that alfalfa and oats and lespedeza would be custom harvested. Production for sale of 1.4 acres of alfalfa to be harvested on a custom basis does not appear feasible. To make the program more reasonable, the acreage of oats and lespedeza could be expanded to the extent that would be possible by freeing the resources committed to the alfalfa enterprise. After these minor adjustments, the farm plan as developed appears reasonable.

#### *Stability of Optimum Organization*

Changes in product and factor prices alter the optimum combination of activities. Under the optimum organization, most of the net revenue from the farm comes from two activities, nonfarm employment and production of commercial eggs. Changes in prices of these commodities would affect net family revenue. The part-time farm used in this analysis is typical of a large number of farms. If this program is put into effect on a large number of farms, the changes in production will cause product prices to decline. Aggregate changes in the production of farm commodities other than eggs are small, and price changes as a result of farm reorganization likely would be small. The aggregate production of eggs, however, would be greatly increased. Also, a recent growth in nonfarm employment in the Southern Piedmont has been accompanied by a general upward trend in nonfarm wage rates. An increase in wage rates provides an incentive for additional nonfarm employment.

In view of the large proportion of the income from the optimum organization made up of returns from nonfarm employment and from the sale of eggs, it appeared desirable to examine the effects of changes in the prices of eggs and of labor in nonfarm employment on the optimum use of farm resources. Wage rates likely to be available to farm persons in nonfarm employment in the Piedmont range from 75 cents to \$1.50 per hour. The price of eggs has varied in recent years from 35 cents to 60 cents per dozen on an annual average. These price ranges are used to determine the effects of changes in prices from those used in developing the initial program. These were 43 cents per dozen price of eggs and \$1.30 per hour price of nonfarm labor.

The net revenue from the commercial layer enterprise was considered as a function of the price of eggs, and the net revenue from nonfarm employment was considered as a function of the price of labor in nonfarm employment. The net revenue of all other enterprises was considered as a function of the price of eggs and the price of labor in nonfarm employment. In this way, it was possible to fix the price of labor or the price of eggs and to determine the extent to which the price of the other com-

TABLE 3. OPTIMUM SCALE OF ENTERPRISES AND ESTIMATED RANGE IN NET REVENUE FOR OPTIMAL PROGRAMS UNDER ALTERNATIVE PRICES OF COMMERCIAL EGGS AND NONFARM WAGE RATES

Enterprises	Areas							J			
	A	B	C	D	E	F	G	H	I	K	J
P <sub>1</sub> Cotton	2.680	1.331	2.542	3.203	3.237	1.394	1.256	1.878	2.964	2.576	1.819
P <sub>2</sub> Corn	9.821	11.171	9.959	9.298	9.265	11.107	11.246	10.623	9.658	9.925	10.683
P <sub>3</sub> Oats & leap.	11.572	10.807	12.936	10.962	10.962	10.823	12.188	10.385	9.251	12.936	8.674
P <sub>4</sub> Alfalfa	1.424	1.424				1.425					
P <sub>5</sub> Layers	1.090		1.090	1.089	1.065				.892	1.066	
P <sub>6</sub> Layers	2.447	3.347	2.432	2.273	2.252	3.305	3.201	3.140	2.318	2.410	2.996
P <sub>7</sub> Nonfarm male				.119	.067		.190	.070		.120	
P <sub>8</sub> Garden					1			.939	1		
P <sub>9</sub> Home milk						1		1	1	1	
P <sub>10</sub> Home eggs									.698		
P <sub>11</sub> Hogs										.698	
Estimated range in net revenues	\$ 9,126	\$ 8,952	\$ 8,802	\$ 8,021	\$ 6,776	\$ 8,843	\$ 8,730	\$ 7,617	\$ 6,761	\$ 8,728	\$ 6,734
	\$14,106	\$11,411	\$12,441	\$12,074	\$8,809	\$8,951	\$8,844	\$8,728	\$7,598	\$9,120	\$7,592

modity could vary without altering the optimum program. The results are shown in Figure 1. The levels at which the active processes would be conducted are shown in Table 3.

The commercial egg enterprise does not exist in combinations B, F, G, H, and J. Hence, at prices less than exist in these regions, the price of eggs is not effective in determining optimum enterprise combinations, and the optimum will not change even if the price of eggs should go to zero.

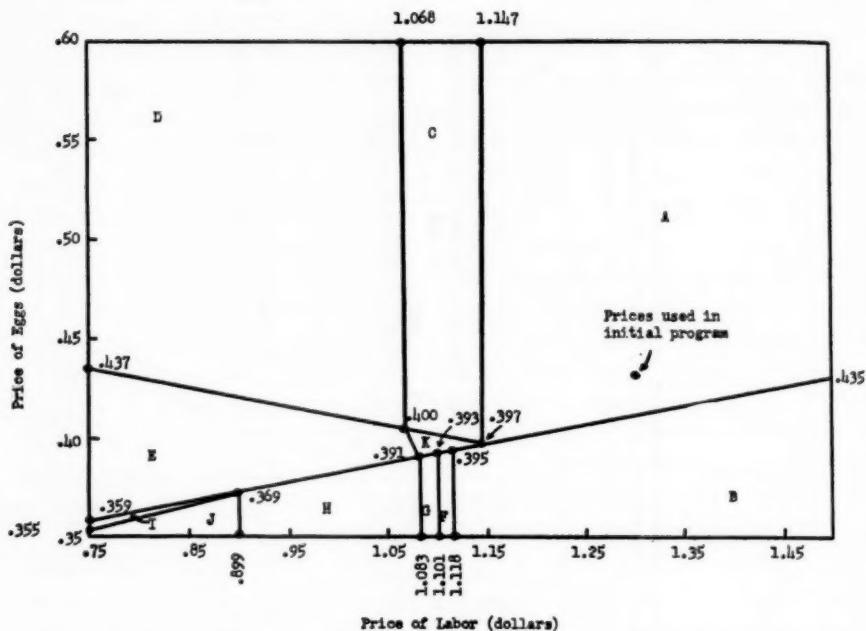


FIG. 1. EFFECTS OF CHANGES IN PRICES OF LABOR AND EGGS  
ON OPTIMUM RESOURCE USE.

Only if the price of nonfarm labor is \$1.147 per hour will the optimal organization change when the price of eggs reaches 60 cents per dozen. At other points, optimal organizations A, C, and D extend to egg prices higher than 60 cents.

Changes in prices of eggs and in prices of labor in nonfarm employment result in minor changes in the optimum organization of part-time farms until the price of eggs becomes so low relative to the price of non-farm employment that it is no longer profitable to engage in the production of commercial eggs. In moving from A through C to D, there is little change in the optimum. The most significant differences are involved in a movement from A and E to B and H. Production of commodities for home use increases as the price of labor in nonfarm employment decreases.

In delineation of the ranges within which prices could vary without changing the optimal organization, the costs of constructing a laying house and purchasing poultry equipment are included in the variable costs. Once the layer process has been activated, these items became a part of fixed costs. A farmer planning to begin the production of eggs would be affected to a greater extent by changes in the price of eggs than a farmer already engaged in producing eggs. The areas in Figure 1 are

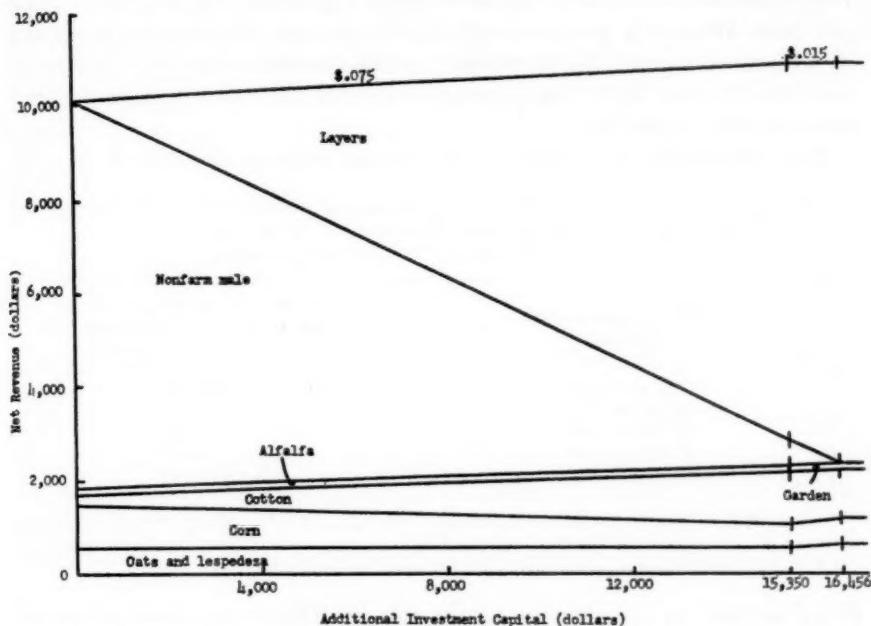


FIG. 2. AMOUNTS AND SOURCES OF NET REVENUE UNDER OPTIMUM FARMING SYSTEMS WITH SPECIFIED QUANTITIES OF ADDITIONAL INVESTMENT CAPITAL, TYPICAL PART-TIME FARM, SOUTHERN PIEDMONT AREA, NORTH CAROLINA.\*

\* Slope of net revenue line represents marginal productivity of capital in dollars per dollar invested.

optimal for the farmer who is planning to begin production of commercial eggs.

Changes in prices of eggs and of nonfarm labor greatly alter the net revenue resulting from a given organization. In Table 2, for example, under organization A, net revenue ranges from \$9,126 to \$14,106; under J it ranges from \$6,769 to \$7,628.

#### *Effects of Changes in Capital Restrictions on Optimal Resource Use*

The preceding farm programs have been developed under the assumption that capital was limited to \$4,500. If the price of capital is 5 per

cent per year, the net marginal productivity of additional capital, under the initial price assumptions, is 7.5 cents per year per dollar invested. In view of this, the restriction on investment capital was removed to determine the manner in which the optimum farm program and the productivity of capital changed as the quantity of capital varied. As shown in Figure 2, the value of the marginal product of capital is constant from zero additional capital to \$15,350 additional capital. In the range \$15,350 to \$16,456, the net marginal productivity of capital is 1.5 per cent. When the price of capital is 5 per cent, the maximum amount of additional capital that it would pay the farmer on the typical farm to invest is \$16,456. With this quantity of capital, the estimated net revenue to the family is \$10,843.

The availability of nonfarm employment reduces the effects of addi-

TABLE 4. RETURNS FROM ADDITIONAL INVESTMENT IN OPTIMUM FARMING SYSTEMS  
ON A TYPICAL NONMECHANIZED FARM WITH 27 ACRES OF CROPLAND,  
SOUTHERN PIEDMONT AREA, NORTH CAROLINA

Additional investment (dollars)	Increase in annual net income per additional dollar invested in the specified ranges
Up to \$4,300	\$0.519
\$4,301-\$6,500	0.457
\$6,501-\$7,000	0.408
\$7,001-\$8,000	0.244
Over \$8,000	0.000

Source: J. G. Sutherland and C. E. Bishop, *Possibilities for Increasing Production and Incomes on Small Commercial Farms, Southern Piedmont Area, North Carolina*, Technical Bulletin 117, N. C. Agricultural Experiment Station, December, 1955.

tional capital on net revenue to the family. The major effect of investment of additional capital is to increase the income from the farm and to decrease the income from nonfarm employment. Most of the increase in income from the farm results from an expansion in egg production. Without additional capital, commercial eggs could not be produced, and nonfarm employment provides most of the net revenue to the family. With an additional investment of \$16,456, the number of layers in the optimal program is 3,978, and nonfarm employment is no longer profitable.

Removal of nonfarm employment as a potential activity would greatly change the relation of investment capital to net family revenue. The productivity of additional capital on a typical nonmechanized small commercial farm in the Piedmont is shown in Table 4. The net marginal productivity is 52 cents per dollar per year when additional capital is limited to \$4,300. The marginal productivity decreases as the amount of capital used increases. The typical small commercial farm had less

labor than the part-time farm and was nonmechanized. These factors reduce the amount of capital that it would pay to invest on the small commercial farm in comparison with the part-time farm.

### *Conclusions*

The preceding analysis indicates that the combination of farm and nonfarm uses of farm family resources is profitable to many farm families. Under the assumed conditions no land would remain idle if people on typical part-time farms had information relating to the productive potential and were motivated by net revenue.

The stability of optimal farm programs, with respect to changes in prices of major commodities, is significant from the standpoint of product choice. Large changes in prices can be absorbed before it pays the operator to change the use of his resources. In fact, the major question confronting farm operators is whether or not the price of eggs will fall so low that it will no longer be profitable to engage in the production of commercial eggs.

The net marginal productivity of investment capital is higher on small commercial farms than on part-time farms. Families on part-time farms substitute nonfarm employment for enterprises using large amounts of capital when capital is restricted. In this way they are able to reduce the effects of capital restriction on net family income.

Programming procedures provide economists with tools that are readily adapted to evaluating intrafirm adjustments. The results obtained from programming analyses, however, are no better than the data upon which the analyses rest. Programming procedures emphasize the need for more refined input-output data from the standpoint of particular enterprises and focus attention on the need for rigorous aggregative analysis from the industry point of view. The construction of price maps is helpful in delineating the range in prices within which farmers can expect a particular program to be optimal. This procedure, however, does not answer the question as to the probability that prices will fall within the particular ranges.

## APPLICATION OF PROGRAMMING ANALYSIS TO CORN BELT FARMS

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**L**INEAR programming is a valuable adjunct to the techniques available to the research worker in farm management. In terms of its application to farm management, it may be conveniently defined as a highly formalized type of farm planning or budgeting. In comparison with farmers in other agricultural regions, Corn Belt farmers frequently face a wider range of alternative enterprises from which to select a farming system. This, coupled with the complex interrelationships between crops and livestock, makes linear programming a particularly useful technique for farm planning in the Corn Belt.

Development of a farm budget usually follows a preliminary analysis that serves to discover maladjustments in the farm business. It is important that linear programming be distinguished from the diagnostic techniques used in this preliminary phase.

Two of these essentially diagnostic methods employed by farm management research workers are (1) farm record analysis and (2) production function analysis. Farm record analysis consists chiefly of establishing relationships by multiple regression or cross-classification between (a) some measure of financial success of a single enterprise or the total farm business and (b) certain "factors" such as crop yield index, size of farm, pigs per litter, etc. The relative importance of each of these "factors" is used as a starting point in the analysis of any particular farm business. Thus, if crop yields "explain" a high percent of the interfarm variation in income, then the first characteristic to examine in an analysis of any particular farm is crop yields.

Studies of production functions of Corn Belt farms have usually employed a function linear in the logarithms of the variables with the dependent variable being some measure of value of production and the independent variables being such input aggregates as land, labor, machinery, livestock, etc. If the marginal value productivity of a resource is estimated to be higher than the market price of the resource, it is likely that too little of that resource is, in general, being used. An estimated marginal value productivity lower than the market price of the resource has the opposite interpretation.

Neither of these techniques yields a satisfactory framework for the planning or reorganization, in any detail, of a farm business to yield higher income. The farm-account analysis characteristically has difficulty in identifying cause-effect relationships and hence usually can only sug-

gest areas of the farm business that may need attention. Although the logic of the production function offers improvement, aggregation of inputs and products is, among other things, a serious problem in interpreting the results of a production-function analysis.<sup>1</sup> Consequently, these diagnostic techniques are employed as a preliminary step to the development of a plan for the future operation of a farm unit.

In this paper an illustration of applying linear programming to the problem of planning a Corn Belt farm will be presented with three objectives in mind. First, an attempt will be made in the presentation of the programming model to mention, for purposes of contrast, the customary method of treating the various phases of the planning process. Second, the maximum profit plans for various price situations will be presented to indicate the sensitivity of the results to changes in price structure. Finally, a few comments will be made on a by-product of a linear programming solution that is not available from the conventional budget.

### *The Farm Situation Considered*

An owner-operator is farming 200 acres of Muscatine Silt Loam, a highly productive soil found in Illinois and Iowa. The soil is in a high state of productivity.<sup>2</sup> He has \$10,000 operating capital available for expenditures in the farm business. In addition to his own labor of 240 hours per month, the labor of a son attending school is available. This gives a total labor supply of 300 hours per month during the school year and 400 hours per month during the summer. A full complement of machinery is available. Building space is available for feeding cattle and hogs; 1,600 square feet is unspecialized and may be used by either cattle or hogs and 2,000 square feet is available for use only by hogs.

### *Activities considered*

Eight cropping systems are considered as alternatives. A cropping system is defined as a combination of a crop rotation and a fertilizer program. The variation in corn yield for a given rotation is due to the level of nitrogen fertilizer application. The eight cropping systems are as follows:

<sup>1</sup> James S. Plaxico, "Problems of Factor-Product Aggregation in Cobb-Douglas Value Productivity Analysis," *Journal of Farm Economics*, 37:664-675, November, 1955. Earl R. Swanson, *Determining Optimum Size of Business from Production Functions*, University of Illinois, Agricultural Experiment Station, Research Report No. 2, October, 1954.

<sup>2</sup> For application of the programming technique to selection of alternative methods of building up soil fertility see Earl R. Swanson, "Selecting Fertilizer Programs by Activity Analysis," 1955 Tennessee Valley Authority Symposium on Economics of Fertilizer Use.

$x_1$  = acres of corn-corn-oats (clover catch crop), 85 bushel corn yield  
 $x_2$  = acres of corn-corn-oats (clover catch crop), 75 bushel corn yield  
 $x_3$  = acres of corn-corn-oats (clover catch crop), 65 bushel corn yield  
 $x_4$  = acres of corn-soybeans-oats (clover catch crop), 87 bushel corn yield  
 $x_5$  = acres of corn-soybeans-oats (clover catch crop), 77 bushel corn yield  
 $x_6$  = acres of corn-soybeans-oats (clover catch crop), 67 bushel corn yield  
 $x_7$  = acres of corn-corn-oats-clover, 90 bushel corn yield  
 $x_8$  = acres of corn-corn-oats-clover, 80 bushel corn yield

The conventional budgeting procedure in the Corn Belt usually starts with selection of the cropping system based primarily on the "best" use of the land. Programming permits simultaneous consideration of the livestock system as well as the primary resources in selection of an optimum plan. These eight cropping systems could be "budgeted out" rather easily by placing market values on all resources and products and the high-profit cropping system selected. However, this may be unsatisfactory for several reasons. If any resource that is in limited supply is also required by a livestock enterprise, the market price for this resource may be inappropriate. The opportunity cost in livestock production is the appropriate charge for the resource. It is customary, in conventional budgeting, to charge labor at a flat rate during all seasons of the year. Such a rate does not usually reflect the marginal value productivity of labor in the various seasons of the year.

The roughage produced by these rotations may also be difficult to price. Due to the bulky nature of roughage there is usually a wide difference between the purchase price and the selling price.<sup>3</sup> Conceivably the marginal value productivity of roughage in livestock production may not correspond to either of these "market" prices. The marginal value productivity of roughage in feeding is considered implicitly in a linear programming model containing appropriate livestock alternatives. Selling and purchase activities may also be introduced if direct sale and purchase are to be alternatives.

With the advent of cheaper forms of commercial nitrogen, the role of legumes in many Corn Belt rotations is currently being examined. Legumes yield a joint product. In addition to the nitrogen produced for succeeding crops, they furnish roughage that may be used as livestock feed. Valuation of the nitrogen in legumes for purposes of comparison with commercial nitrogen is very difficult to perform unless the total farm business is considered. Linear programming essentially by-passes this problem of placing an explicit price on the legume and provides directly the optimum plan, which is of course, the objective of pricing the nitrogen in a legume.

In order that certain livestock alternatives that consume hay may be

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<sup>3</sup> Glenn L. Johnson and Lowell S. Hardin, *Economics of Forage Valuation*, Station Bulletin 623, Agricultural Experiment Station, Purdue University, April 1955.

considered in the specific problem at hand, two hay-making activities are introduced:

$$\begin{aligned}x_9 &= \text{tons of hay harvested in June} \\x_{10} &= \text{tons of hay harvested in July}\end{aligned}$$

Corn silage is an important component of the cattle ration in many areas of the corn belt. Accordingly, a silage-making activity is also provided. A single activity suffices since the operation must be performed in a relatively short period of time.

$$x_{11} = \text{tons of corn silage produced}$$

Three alternative hog activities are considered. Each represents two litters a year and employs a different ration with respect to the proportion of corn and soybean oil meal. Thus a unit level of each activity describes a point on an isoquant. It might appear that the minimum cost ration could be determined by simply comparing the costs of the three rations and entering only the single minimum cost activity into the programming model. If protein supplement is purchased with funds that may possibly have a higher rate of return in other enterprises, such predetermination of the minimum cost ration cannot be performed with any surety. The appropriate "price" for the protein supplement cannot easily be anticipated in cases where the capital limitation is effective.

The hog activities are as follows:

$$\begin{aligned}x_{12} &= \text{number of hogs (market weight 225 pounds), fed high-protein ration} \\x_{13} &= \text{number of hogs (market weight 225 pounds), fed medium-protein ration} \\x_{14} &= \text{number of hogs (market weight 225 pounds), fed low-protein ration}\end{aligned}$$

The cattle feeding activities assume the purchase of good-to-choice feeder calves weighing 400 pounds. Six alternative feeding methods are considered for the feeding operation. The gains are assumed to be 500 pounds per animal except for those on limited grain feeding. These animals gain 550 pounds.

$$\begin{aligned}x_{15} &= \text{number of calves full fed on drylot without silage} \\x_{16} &= \text{number of calves full fed on pasture without silage} \\x_{17} &= \text{number of calves fed limited grain on pasture without silage} \\x_{18} &= \text{number of calves full fed on drylot with silage} \\x_{19} &= \text{number of calves full fed on pasture with silage} \\x_{20} &= \text{number of calves fed limited grain or pasture with silage}\end{aligned}$$

Predetermination of the optimum method out of the context of the total farm business is again difficult because of the inability to anticipate the appropriate "price" of a resource that is in limited supply.

In order that livestock numbers may be extended, if profitable, beyond the grain production of the farm, provision is made for purchase of corn and oats:

$$\begin{aligned}x_{21} &= \text{bushels of corn purchased} \\x_{22} &= \text{bushels of oats purchased}\end{aligned}$$

A common procedure in conventional budgeting is to limit livestock production to the grain produced. This is a convenient rule of thumb that restricts expansion of the livestock when perhaps some other resource or uncertainty is actually limiting.

Sales activities are introduced as follows:

- $x_1$  = bushels of corn sold
- $x_2$  = bushels of oats sold
- $x_3$  = bushels of soybeans sold
- $x_4$  = tons of hay sold

In the event that the \$10,000 available for spending is not used in the farm business a lending activity is provided:

- $x_5$  = dollars loaned at five percent interest

A borrowing activity could, of course, be introduced if such had been applicable to the situation considered.

Finally, an activity is needed to permit the unspecialized livestock housing to be made available for the hog enterprise in the event cattle do not occupy the space:

- $x_6$  = square feet of unspecialized space available for the hog enterprise

#### *Restraints on profit maximization*

The following 18 restraints specify the relationships between available resources and their use by the activities.\*

$$\text{Land} \quad (1) \quad \sum_j a_{1j}x_j \leq 200 \text{ acres} \quad j = 1, 2, 3, \dots, 28$$

$$\text{Capital} \quad (2) \quad \sum_j a_{2j}x_j = 10,000 \text{ dollars}$$

Labor in only the indicated months is believed likely to be limiting:

$$\text{March labor} \quad (3) \quad \sum_j a_{3j}x_j \leq 300 \text{ hours}$$

$$\text{April labor} \quad (4) \quad \sum_j a_{4j}x_j \leq 300 \text{ hours}$$

$$\text{May labor} \quad (5) \quad \sum_j a_{5j}x_j \leq 300 \text{ hours}$$

$$\text{June labor} \quad (6) \quad \sum_j a_{6j}x_j \leq 400 \text{ hours}$$

$$\text{July labor} \quad (7) \quad \sum_j a_{7j}x_j \leq 400 \text{ hours}$$

$$\text{August labor} \quad (8) \quad \sum_j a_{8j}x_j \leq 400 \text{ hours}$$

$$\text{September labor} \quad (9) \quad \sum_j a_{9j}x_j \leq 300 \text{ hours}$$

$$\text{October labor} \quad (10) \quad \sum_j a_{10j}x_j \leq 300 \text{ hours}$$

$$\text{Unspecialized building space} \quad (11) \quad \sum_j a_{11j}x_j \leq 1,600 \text{ square feet}$$

$$\text{Hog building space} \quad (12) \quad \sum_j a_{12j}x_j \leq 2,000 \text{ square feet}$$

\* The coefficients or planning standards,  $a_{ij}$ , are based on those in *Illinois Farm and Home Development Reference Book*, University of Illinois, College of Agriculture, January 1955.

The remaining six relations act to transfer products from the crop enterprises to either consumption by livestock or direct sale. Purchase of corn and oats is also permitted. Pasture may be consumed directly by the livestock, transformed into hay, or simply be produced in surplus. Only a single hay equation is needed since the product is assumed to be substantially the same whether produced in the first or second hay-making period.

The relations pertaining to the commodities that are to have an alternative of direct cash sale are written as equalities:<sup>5</sup>

$$\text{Corn} \quad (13) \quad \sum_j a_{13j}x_j = 0$$

$$\text{Oats} \quad (14) \quad \sum_j a_{14j}x_j = 0$$

$$\text{Soybeans} \quad (15) \quad \sum_j a_{15j}x_j = 0$$

$$\text{Hay} \quad (16) \quad \sum_j a_{16j}x_j = 0$$

The commodities of pasture and corn silage were assumed to have no market value, hence the relations concerning these may be written as inequalities:

$$\text{Pasture} \quad (17) \quad \sum_j a_{17j}x_j \leq 0$$

$$\text{Corn silage} \quad (18) \quad \sum_j a_{18j}x_j \leq 0$$

### *Profit relation*

The linear function representing income, I, to be maximized may be written:

$$(19) \quad I = \sum_j x_j c_j \quad j = 1, 2, 3, \dots, 28$$

where the  $c_j$  denote the prices of a unit level of each of the activities. The overhead costs on machinery have not been included. These are assumed to be substantially the same irrespective of the cropping and livestock system selected. Out-of-pocket costs do not explicitly enter the income equation but are considered for each activity in the capital restraint (2). Thus the income described in (19) is a gross income figure and would need to have the \$10,000 capital available deducted to yield a "net" income. The price,  $c_j$ , on the lending activity is \$1.05; both principal and interest of the loan are assumed to be repaid. In addition to the overhead costs for machinery, this "net" income does not include a deduction for land, labor, and buildings since these resources were assumed to have zero disposal price or opportunity cost.

A planning period of sufficient length to obtain the effects of cropping

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\* The selling activities ( $P_{11}$  through  $P_{28}$ ) may conveniently be placed in the unit basis at the start of the simplex calculations. This also applies to the lending activity,  $P_n$ . The disposal activities for pasture and corn silage have zero price in this problem.

TABLE I. ILLINOIS FARM PRICES, 1945-54<sup>a</sup>

	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	Average 1945-54
Hogs per 100 lb.	\$11.25	\$17.53	\$24.44	\$23.66	\$18.51	\$18.17	\$20.35	\$18.13	\$21.94	\$21.90	\$19.80
Choice steers per 100 lb.	16.00	19.32	26.22	30.98	26.07	29.68	35.98	33.18	24.14	24.66	30.68
Good-to-choice feeder calves per 100 lb. <sup>b</sup>	10.25	13.67	16.77	21.31	27.21	24.22	32.97	38.10	27.35	17.96	32.98
Corn per bushel	1.91	1.51	2.22	1.97	1.25	1.59	1.75	1.55	1.48	1.50	1.45
Oats per bushel	.67	.80	1.06	.71	.64	.80	.85	.82	.71	.70	.75
Soybeans per bushel	2.08	2.52	3.39	2.99	2.10	2.49	2.80	2.90	2.79	2.70	2.62
Hay per ton	10.60	19.70	23.10	23.80	21.00	21.30	21.00	23.00	25.00	25.00	32.35
Soybean meal per ton <sup>c</sup>	52.00	62.40	81.10	91.60	76.40	64.60	76.90	96.25	80.00	88.50	77.98

<sup>a</sup> Source: *Illinois Agricultural Statistics, Livestock Market News Statistics, and Agricultural Statistics*.<sup>b</sup> Average price for September, October, and November of previous year.<sup>c</sup> Average price for year beginning in the preceding October.

sequence on yields is assumed. The application of the programming technique to a farm planning problem of more than one production period with the outcome of the first production period determining later production has been discussed previously.<sup>6</sup> In the problem at hand, the assumed level of soil fertility is sufficiently high to obtain the indicated yields in the first year. It is assumed that no livestock remains from the previous production period. The results for various price situations are presented in the following section.

#### *Sensitivity of Results to Price Changes*

An important factor determining the usefulness of an optimal plan developed for a typical farm resource situation within an area is the sensitivity of the plan to price changes. If the optimal solution relates to a production period of considerable length, an organization permitting flexibility needs to be compared with a rigid plan that would be followed irrespective of changed price expectations. The choice will be conditioned by the magnitude of the losses in years when the rigid plan is not optimal as compared to the added cost of integrating flexibility into the organization.

One method of gaining insight into this problem is to determine the changes in the optimal plan that result from using various historical price structures. Solutions to the problem presented were computed using prices in each of the ten years 1945-54 (Table 1), as well as the set of ten-year average prices. These eleven solutions are presented in Table 2. The same plan is optimal in five out of the ten years (1945, 1946, 1947, 1950, and 1951). The modal plan is also the one that results from using average prices for the ten-year period. This need not, of course, always be the case. The losses that would occur by following the modal plan instead of the optimal plan for that particular year in the years 1948, 1949, 1952, 1953, and 1954 are presented in the last line of Table 2. In comparing a rigid plan with one permitting flexibility, these losses would need to be compared with the additional costs of a flexible organization.

Programming is particularly useful in exploring a problem of this nature since the method insures that, given the technical assumptions, the resulting plan yields maximum profits for the price structure used. On the other hand, conventional budgeting could compare only the "best judgment" of what constituted the maximum profit plan for each price structure.

<sup>6</sup> Earl R. Swanson, "Integrating Crop and Livestock Activities in Farm Management Activity Analysis," *Journal of Farm Economics*, 37:1249-58, Proceedings Number, December 1955.

TABLE 2. OPTIMAL ACTIVITY LEVELS UNDER VARIOUS PRICE SITUATIONS

Activity	Unit	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	Average 1945-54
P <sub>1</sub> corn-corn-oats (high-level nitrogen)	acres	94	94	94	—	41	94	49	154	41	64	—
P <sub>2</sub> corn-soybeans-oats (high-level nitrogen)	acres	—	—	—	57	84	—	71	—	84	—	—
P <sub>3</sub> corn-corn-oats-clover (high-level nitrogen)	acres	106	106	111	75	106	106	80	46	75	106	—
P <sub>4</sub> June hay-making	tons	4.5	4.5	4.4	0.4	4.5	4.5	1.0	0.8	0.4	4.5	4.5
P <sub>5</sub> July hay-making	tons	0.6	0.6	0.6	10.9	0.6	0.6	10.7	21.3	10.9	0.6	0.6
P <sub>6</sub> : Corn silage production	tons	62.2	68.2	68.2	96.0	68.1	67.3	62.8	67.2	68.1	68.1	68.1
P <sub>7</sub> : Hogs, high protein ration	head	—	—	—	—	—	—	—	—	37	—	—
P <sub>8</sub> : Hogs, medium protein ration	head	—	—	—	—	—	—	—	—	—	—	—
P <sub>9</sub> : Cattle, full fed on pasture with	head	12	12	12	64	45	12	12	41	—	45	12
P <sub>10</sub> : Cattle, limited-grain-fed on pasture with silage	head	92	92	92	—	92	92	92	92	92	92	92
P <sub>11</sub> : Corn sold	bushels	8,698	8,698	8,698	3,511	6,901	8,698	8,698	6,441	10,279	6,001	8,698
P <sub>12</sub> : Oats sold	bushels	5,556	5,556	5,556	2,879	4,749	5,556	5,556	5,781	5,781	5,781	5,556
P <sub>13</sub> : Soybeans sold	bushels	—	—	—	—	920	—	—	787	—	930	—
P <sub>14</sub> : Hay sold	tons	—	—	—	—	—	—	—	—	—	30.7	—
P <sub>15</sub> : Funds loaned	dollars	5,375	4,865	4,864	1,687	1,854	4,378	2,179	—	5,570	3,465	5,358
P <sub>16</sub> : Cattle housing available for hogs	square feet	750	750	750	—	466	750	750	507	1,600	466	750
Gross income	dollars	25,626	27,815	35,980	98,705	24,580	29,685	31,940	25,450	26,280	27,905	26,935
Gross income under modal plan	dollars	\$26,625	\$27,915	\$35,980	\$35,185	\$21,085	\$20,635	\$31,940	\$24,005	\$22,940	\$24,505	\$26,935
Loss	dollars	—	—	—	—	5,520	3,495	—	—	4,425	\$3,550	\$4,400

### *Additional Information Yielded by Programming Solution*

Another advantage of linear programming over the more usual planning methods is found in a by-product of the solution proper when the simplex method is used. The values usually referred to as  $z_j - c_j$  frequently aid in the interpretation of the plan itself as well as to suggest deviations from the optimal plan.<sup>7</sup> Our purpose in this section is to suggest how the  $z_j - c_j$  values might be used.

An alternative method of studying the sensitivity of the optimal plan to price changes is that of examining the  $z_j - c_j$ . Consider the optimal plan using average prices for the period 1945-54 (last column, Table 2). Note that no hogs appear in this plan. Hogs have been more popular than cattle rather consistently in most linear programming solutions using a model of this general nature. However, in this model the corn silage feeding alternative gives cattle the advantage.

It may be of interest to know how much higher the price of hogs would need to be in this problem in order for them to enter the optimal plan. Since the quantities  $z_j - c_j$  must all be positive at the final iteration, the price  $c_j$  must be increased enough to make the quantity  $z_j - c_j$ , negative for, in this case, hogs. An examination of  $z_{12} - c_{12}$ ,  $z_{13} - c_{13}$ , and  $z_{41} - c_{41}$  indicates that increasing the hog price \$4.37 per hundred will cause the high protein fed hogs to enter the final plan. This was done and the revised plan that yields the same gross income (\$28,235) has the following changes in the cropping system and the livestock activities:

- P<sub>1</sub> corn-corn-oats (85 bushel yield)—decreased from 94 to 79 acres
- P<sub>7</sub> corn-corn-oats-clover (90 bushel yeild)—increased from 106 to 121 acres
- P<sub>12</sub> hogs fed high protein ration—increased from 0 to 12
- P<sub>19</sub> cattle full fed on pasture with silage—decreased from 12 to 0
- P<sub>20</sub> cattle limited feeding on pasture with silage—increased from 22 to 30

(Other changes in the sales and intermediate input processing activities also occur.)

By increasing the hog price to the level where this enterprise would appear in the final program, a shift in the cropping system also takes place. This was due to the increase in the numbers of cattle requiring large amounts of roughage (P<sub>20</sub>) more than offsetting the decrease in the cattle full fed on pasture (P<sub>19</sub>). The adjustments in other areas of the farm business that accompanied this partial substitution of hogs for cattle could not easily, if at all, have been anticipated by conventional budgeting methods.

The assumptions of linear programming require that at least some resource be available in fixed supply. The stocks of such fixed resources

<sup>7</sup> A. Charnes, et al., *An Introduction to Linear Programming*, New York: John Wiley and Sons, 1954.

may, however, be increased in later production periods. The values of the  $z_j \cdot c_j$  for those vectors originally in the unit basis (as contrasted to those vectors originally in the structure) are the marginal value productivities of the various resources. These  $z_j \cdot c_j$  may give an idea of the priority that might be established for obtaining additional amounts of resources. In the problem solution using average prices 1945-54 (Table 2) we have the following  $z_j \cdot c_j$  values for labor during months in which labor was an effective restraint:

April labor	\$13.90 per hour
May labor	\$10.86 per hour
June labor	\$10.86 per hour

This indicates that the limited supply of April labor is a greater bottleneck than the fixed supply of labor during other months. Care must be taken in interpreting the absolute levels of these marginal value productivities. The fact that certain costs (e.g., overhead on machinery and equipment) have been omitted on the assumption that these costs would be the same for all plans, may tend to overstate these marginal value productivities in the context of a longer production period in which more costs are variable.

The  $z_j \cdot c_j$  for land (using average prices 1945-54) is \$29.80 per acre, which when capitalized at 5 percent gives a value of \$596. Land of this inherent quality, with the high fertility level assumed for this problem, is currently selling for slightly less than this figure.

#### *Concluding Remarks*

Linear programming is a valuable addition to the tools available to farm management workers in the Corn Belt. The nature of its analytical advantage in comparison with conventional budgeting has been outlined. An added benefit is that linear programming forces the research worker to think about the relationships in the farm business in a more rigorous fashion. Further, insofar as the programming model approximates reality, the deficiencies in our stock of useful technical coefficients are exposed. The ability to investigate more readily the effect of price changes, coefficient changes, etc., on the optimal solutions is a factor in making programming a powerful analytical tool.

On the other hand, programming is not at the present time a replacement for the farm planning done by individual farmers themselves. However, the results of a programming solution for a typical problem situation may serve as a useful check on the general nature of recommendations made to farmers. The usefulness of such a "standard" or "benchmark" farm depends on the homogeneity of the resources available among farms within the area for which the solution is intended, as well

as the variation among farmers with respect to technical coefficients. Different plans may be developed, however, for a range of technical coefficients and resource supplies. The limit of the number of plans would depend on, among other things, the computational facilities available. Each solution presented in this paper required about 15 minutes of computing time on an electronic computer (Illiac). If "recipes" are to be developed for large numbers of individual farms better data on the technical coefficients applicable to particular farms will be needed.

## SOLVING FEED PROBLEMS THROUGH LINEAR PROGRAMMING

I. KATZMAN  
*Armour and Company*

**M**Y JOB, today is to give a few simple and practical examples of the application of linear programming to the food industry.

One of the big problems facing a food company like Armour and Company, which purchases many different raw materials that go into a multitude of finished food products, is to find combinations that meet certain legal and technological specifications at cheapest raw material cost.

This, of course, is a general problem facing all processing industries and is a type of problem that can be readily solved by linear programming. I would like to make clear that this is the only one type of problem that can be solved by linear programming. Other problems conceptually more complicated, which involve such considerations as plant capacity, customer requirements, storage space, limited working capital, etc., can also be solved. However, in gaining experience with the technique it was important to choose a type of problem, where the necessary technical details were already known, where the amount of computation would not be overwhelming and of course where there would be some useful and cost saving results.

We will see that linear programming provides an optimum solution in the situation where a product is to be made having several specifications and it is a question of choosing the lowest cost combination of various possible ingredients which, when put together, will meet all the specifications.

### *Processed Cheese Spread*

One of the first applications of linear programming we made was to the formulation of processed cheese spread. An important problem in the manufacture of process cheese spread is to find a formulation of the raw materials that will meet all the final product specifications and be as cheap as possible to make.

The usual method of formulation is primarily one of trial and error with most attention being paid to whether or not final product specifications are met. Thus, while it is a relatively easy matter, using this method, to find a formulation that will satisfy final product specifications, the manager of the cheese operation is not always sure which formulation will give minimum raw material cost.

The complete problem involves about 7 requirements, most of these being legal ones. We have about 10 different raw materials to choose

from. To bring out some of the essential ideas about linear programming in a graphic manner I would like to take a simplified part of the total problem. Let us assume we wish to satisfy the butterfat requirement (this requirement is a legal one). We wish to satisfy this requirement as cheaply as possible. We have 2 raw materials with which to do this:

- (1) Sweet cream that contains 69% butterfat.
- (2) Curd cheese that contains 34% butterfat.

The butterfat content is determined by chemical analysis.

Specifically the butterfat requirement is that in 100 pounds of finished cheese spread, the amount of butterfat must be equal to or greater than 20 pounds.

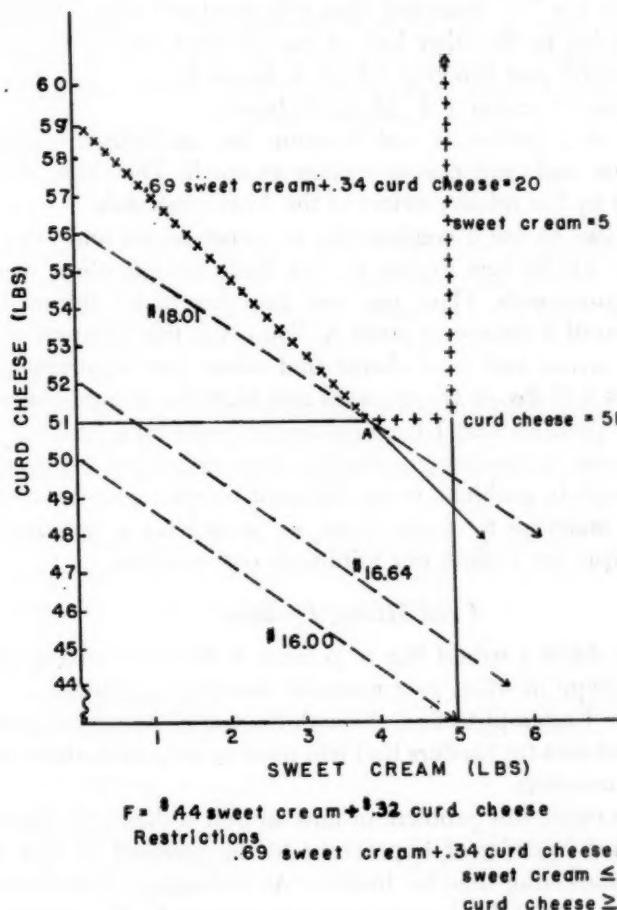


FIG. 1. GRAPHICAL REPRESENTATION OF CHEESE BLENDING PROBLEM.

This requirement may be expressed as the following inequality:

$$(1) .69 \text{ sweet cream} + .34 \text{ curd cheese} \leq 20.$$

Thus there are many combinations of curd cheese and sweet cream that will meet or surpass the butterfat requirement. The above inequality is linear, that is the butterfat from sweet cream and curd cheese is additive. This is a necessary assumption that must be met. We also have two other restrictions:

- (2) Sweet cream  $\leq 5$  lbs.—a technical restriction.
- (3) Curd cheese  $\leq 51$  lbs.—a legal requirement.

The above three requirements are shown graphically in Figure 1. Any point on or in the "+" bounded area will meet our requirements. Now we have to bring in the other half of our problem, that is the cost side. Our raw material cost function which is linear is:

$$F = \$ .44 \text{ sweet cream} + \$ .32 \text{ curd cheese.}$$

Any point on a particular cost function line indicates a combination of sweet cream and curd cheese costing so much. The slope of the line is determined by the relative prices of the 2 raw materials.

We would like to use a combination of sweet cream and curd cheese that cost, say, \$16.00 (see Figure 1), but these combinations would not meet our requirements. Thus, our cost line has to be shifted upward to the right, until it intersects point A. Point A is the cheapest combination of sweet cream and curd cheese that meets our requirements. This combination is 3.85 lbs. of sweet cream and 51.00 lbs of curd cheese.

This simple problem that I have presented could be solved very easily by trial-and-error method, or graphically. However, when we have, as we did in the complete problem, seven different requirements to satisfy and about 10 raw materials to choose from, we must have a systematic computing technique for finding our minimum cost solution.

#### *Feed Mixing Problem*

The next problem I would like to present is the feed mixing problem that is a prototype of many raw material blending problems.

In this paper I attempt to find, through the use of linear programming, a minimum cost diet for broilers that will meet or surpass certain essential nutritive requirements.

To poultry raisers, this problem of how to best utilize feed ingredients is probably next in order of importance to the problem of how to find the optimum marketing time for broilers. An indication of its importance is the fact that cost of feed represents approximately 70 percent of the total cost of producing broilers on a commercial basis.

Poultry raisers, who are interested in maximizing profits, are con-

stantly striving to solve the problem of how to find the least expensive broiler diet and still meet certain nutritive requirements. They do this mainly by trial and error methods and by taking into consideration the nutritive contents and prices of different feed ingredients. Linear programming provides an exact and unique solution to this problem.

The pioneering effort in the application of linear programming to animal nutrition was made by F. V. Waugh.<sup>1</sup> According to Waugh, "The economic problem confronting the dairyman, or the feed manufacturer is essentially one of 'linear programming'; to use a technical phrase. The amounts of nutrients in the feed mixture are linear functions of the quantities of corn, oats, bran and other feeds. The dairyman, or the feed manufacturer, wants to adjust his purchase of each feed ingredient in such a way that the mixture will provide at least a minimum amount of each important nutrient. . . . He attempts to work out an economic 'program,' in other words, to determine how much of each feed ingredient to buy in order to supply all needed nutrients at the least possible cost. Technically, he is trying to minimize a linear function subject to several linear inequalities."

#### *Nutritive requirements*

In his paper, Waugh only considers 4 nutritive requirements that must be met or surpassed, i.e., total digestible nutrients, protein, calcium, and phosphorus, in the feeding of dairy cattle. For the sake of making my solution nutritionally more meaningful I include certain amino acid requirements.

The reason for explicitly including certain amino acid requirements that must be met by the diet is the fact that the protein requirements of an animal is actually a requirement for the amino acids that a protein contains. Unless the proteins in the diet provide adequate quantities of all the amino acids that the broiler is unable to synthesize, growth will be limited in proportion to the inadequacy of any one of these compounds.

The complete list of nutritive requirements is as follows:

- |                   |                   |
|-------------------|-------------------|
| *1. Crude Protein | (f. leucine       |
| 2. Mineral        | (g. phenylalanine |
| *(a. calcium      | (h. threonine     |
| *(b. phosphorus   | (i. valine        |
| 3. Amino Acid     | (j. histidine     |
| *(a. arginine     | (k. cystine       |
| *(b. lysine       | (l. tyrosine      |
| (c. methionine    | (m. glycine       |
| *(d. tryptophane  | *4. Fiber Content |
| (e. Isoleucine    |                   |

<sup>1</sup>F. V. Waugh, "The Minimum Cost Dairy Feed," *Journal of Farm Economics*, Vol. 33, June 1951, pp. 299-310.

A decision was made to simplify the calculations by explicitly putting into the problem only those requirements that are preceded by the symbol.\* This decision was justified by the fact that most feed mixtures usually contain the required amounts of isoleucine, leucine, phenylalanine, threonine, valine, and histidine, cystine, tyrosine and glycine. Also methionine was omitted since it was felt that any such deficiency could be met by a methionine supplement. Methionine is one of the few amino acids that can be made synthetically. For maximum broiler growth it is best not to have the fiber content exceed 4%. This is because fiber content itself makes no nutritive contribution, while at the same time it fills the broiler's limited appetite.

TABLE I. NUTRITIVE CONTENT OF FEED INGREDIENTS, NUTRITIVE REQUIREMENTS AND WHOLESALE PRICES

Feed ingredients	Nutritive contents of feed ingredients <sup>1</sup>							Wholesale price Chicago	
	Crude protein	Calcium	Phosphorus	Arginine	Lysine	Tryptophane	Fiber	1952 <sup>2</sup>	12/55
x <sub>1</sub> -wheat bran	16.40	0.14	1.30	0.95	0.54	0.24	9.00	3.13	2.12
x <sub>2</sub> -Oats, #3	12.00	0.09	0.43	0.60	0.40	0.12	11.00	2.88	2.03
x <sub>3</sub> -Soybean oil meal-(44%)	44.00	0.30	0.66	2.80	2.70	0.53	5.20	4.89	2.86
x <sub>4</sub> -Fish meal (60%)	60.00	5.75	3.20	3.80	4.00	0.69	1.00	8.04	8.50
x <sub>5</sub> -Meat and bone scrap (50%)	50.60	9.70	4.20	3.30	2.80	0.32	2.50	5.60	3.31
x <sub>6</sub> -Steamed bone meal	10.00	29.30	15.10	0.53	1.12	0.16	1.00	4.99	3.02
x <sub>7</sub> -Yellow corn, #3	8.90	0.02	0.27	0.36	0.22	0.06	2.00	3.28	2.06
x <sub>8</sub> -Wheat standard middlings	17.60	0.14	0.78	0.85	0.47	0.20	7.50	3.21	2.12
Nutritive requirements	20.00	1.00	0.60	1.00	0.90	0.25	4.00		

<sup>1</sup> Pounds of each element in 100 pounds of feed ingredient.

<sup>2</sup> Arithmetic averages of midmonthly quotations from January through December, dollars per 100 lbs.

Other mineral requirements and vitamin requirements can be met by the standard mineral and vitamin pre-mixes. Due to mixing considerations the mixture of feed ingredients should be so combined as to weight 100 lbs. Table I shows the minimum number of lbs. of each requirement that must be present in 100 lbs. of feed. The only exception to this is the fiber requirement, which is that no more than 4 lbs. of fiber should be present in 100 lbs. of feed mixture.<sup>2</sup>

### Feeds

There are literally dozens of feed ingredients from which the broiler raiser can select. *The Feed Manual* lists more than 65 that are suitable

\* See H. W. Titus, *The Scientific Feeding of Chickens*, Chicago: The Interstate Publishing Company, 1949.

for poultry feeding.<sup>3</sup> However, to simplify the problem and to make the calculations amenable to a desk calculator, I assume the broiler raiser can manufacture his feed mixture from the feed ingredients listed in Table I. These listed represent most of the feed ingredients commonly used by broiler raisers. Table I also gives the nutritive contents and price of each feed ingredient.

### *Linear Programming*

In this section I briefly discuss just what the technique of linear programming involves. First, I will present the formulation of the general linear programming problem and how it specifically applies to the problem of finding the minimum cost broiler diet.

Linear programming may be formally defined as maximization (or minimization) of a linear form, subject to inequality restraints. That is, we wish to find values of  $x_i$  ( $i = 1 \dots n$ ) that maximize (or minimize)

the linear function  $f = \sum_{i=1}^n c_i x_i$ , where  $c_i$  is generally regarded as

prices.

Subject to the following linear restrictions—

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1j}x_j + \dots + a_{1n}x_n \geq b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2j}x_j + \dots + a_{2n}x_n \geq b_2$$

$$\vdots$$

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1j}x_j + \dots + a_{1n}x_n \geq b_1$$

$$\vdots$$

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mj}x_j + \dots + a_{mn}x_n \geq b_n$$

Also  $x_i \geq 0$ , to remove possibility of having negative inputs. Now, specifically, in the minimum cost broiler feed problem, we have the following function to minimize.

$$(1) \quad f = 3.13x_1 + 2.88x_2 + 4.69x_3 + 8.04x_4 + 5.60x_5 + 4.99x_6 + 3.28x_7 + 3.21x_8$$

where the  $x$ 's represent the feed ingredients in 100 lb. units; that is,  $x_1$  = wheat bran,  $x_2$  = oats, #3,  $x_3$  = soybean oil meal (44%),  $x_4$  = fish meal (60%),  $x_5$  = meat and bone scrap (50%),  $x_6$  = steamed bone meal,  $x_7$  = yellow corn, #3,  $x_8$  = wheat standard middlings, and the numbers are the average 1952 prices of the feed ingredients in dollars per 100 lbs.

Subject to the following requirements:

$$\begin{aligned} \text{Crude protein} &+ 10.40x_1 + 12.00x_2 + 44.00x_3 + 60.00x_4 + 50.60x_5 \\ &+ 10.00x_6 + 8.90x_7 + 17.60x_8 \geq 20.00 \end{aligned}$$

<sup>3</sup>Feed Trade Manual, Edition No. 5, Chicago National Millers Publication, 1947. See also Recommended Nutrient Allowances for Poultry, Washington: National Research Council, 1950.

Table 2. SIMPLEX TABLEAU

Artificial vectors												Structural vectors												Slack vectors											
M M M M M M						S.13 2.88 4.69 8.04 5.60 4.99 3.98						0 0 0 0 0 0 0 0 0 0 0 0						0 0 0 0 0 0 0 0 0 0 0 0						0 0 0 0 0 0 0 0 0 0 0 0						0 0 0 0 0 0 0 0 0 0 0 0					
P <sub>1</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>1</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>1</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>1</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>1</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>						
P <sub>1</sub>	1	1	1	1	1	0.82	0.60	2.20	3.00	2.53	0.65	0.44	0.88	-1	-1	-1	-1	-1	P <sub>1</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>1</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>2</sub>						0.14	0.09	0.30	5.75	9.70	22.80	5.75	0.14						P <sub>2</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>2</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>3</sub>						2.17	0.72	1.10	5.33	7.00	22.23	0.45	1.30						P <sub>3</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>3</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>4</sub>						0.95	0.61	2.80	3.00	3.00	0.53	0.36	0.85						P <sub>4</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>4</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>5</sub>						0.60	0.44	3.00	4.44	3.11	1.94	0.53	0.53						P <sub>5</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>5</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>6</sub>						0.96	0.48	2.12	2.76	1.98	0.65	0.94	0.80						P <sub>6</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>6</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>7</sub>						3.95	8.75	1.50	0.26	0.26	0.62	0.22	0.88						P <sub>7</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>7</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>8</sub>						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						P <sub>8</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>8</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>9</sub>						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						P <sub>9</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>9</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>					
P <sub>10</sub>						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>10</sub>	P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>10</sub>						
P <sub>11</sub>						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						P <sub>11</sub>	P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>10</sub>	P <sub>9</sub>	P <sub>8</sub>	P <sub>7</sub>	P <sub>6</sub>	P <sub>5</sub>	P <sub>4</sub>						
P <sub>12</sub>						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						P <sub>12</sub>	P <sub>13</sub>	P <sub>14</sub>	P <sub>10</sub>	P <sub>9</sub>	P <sub>8</sub>	P <sub>7</sub>	P <sub>6</sub>	P <sub>5</sub>	P <sub>4</sub>	P <sub>3</sub>						
P <sub>13</sub>						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						P <sub>13</sub>	P <sub>14</sub>	P <sub>10</sub>	P <sub>9</sub>	P <sub>8</sub>	P <sub>7</sub>	P <sub>6</sub>	P <sub>5</sub>	P <sub>4</sub>	P <sub>3</sub>	P <sub>2</sub>						
P <sub>14</sub>						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						P <sub>14</sub>	P <sub>10</sub>	P <sub>9</sub>	P <sub>8</sub>	P <sub>7</sub>	P <sub>6</sub>	P <sub>5</sub>	P <sub>4</sub>	P <sub>3</sub>	P <sub>2</sub>	P <sub>1</sub>						

Calcium	$+ 0.14x_1 + 0.09x_2 + 0.30x_3 + 5.75x_4 + 9.70x_5$
	$+ 29.30x_6 + 0.02x_7 + 0.14x_8 \geq 1.00$
Phosphorus	$+ 1.30x_1 + 0.43x_2 + 0.66x_3 + 3.20x_4 + 4.20x_5$
	$+ 15.10x_6 + 0.27x_7 + 0.78x_8 \geq 0.60$
Arginine	$+ 0.95x_1 + 0.60x_2 + 2.80x_3 + 3.80x_4 + 3.30x_5$
(2)	$+ 0.53x_6 + 0.36x_7 + 0.85x_8 \geq 1.00$
Lysine	$+ 0.54x_1 + 0.40x_2 + 2.70x_3 + 4.00x_4 + 2.80x_5$
	$+ 1.12x_6 + 0.22x_7 + 0.47x_8 \geq 0.90$
Tryptophane	$+ 0.24x_1 + 0.12x_2 + 0.53x_3 + 0.69x_4 + 0.32x_5$
	$+ 0.16x_6 + 0.06x_7 + 0.20x_8 \geq 0.25$
Fiber	$+ 9.00x_1 + 11.00x_2 + 5.20x_3 + 1.00x_4 + 2.50x_5$
	$+ 1.00x_6 + 2.00x_7 + 7.50x_8 \leq 4.00$
Weight	$+ 1.00x_1 + 1.00x_2 + 1.00x_3 + 1.00x_4 + 1.00x_5$
	$+ 1.00x_6 + 1.00x_7 + 1.00x_8 = 1.00$

(It should be noted the nutritive elements from different feeds are additive, fulfilling an essential condition of linear programming.)

The problem is to choose  $x_i$ ,  $i = 1 \dots 8$ , in such a fashion that  $f$  will be a minimum and the inequalities in (2) will be satisfied. The inequalities in (2) may be transformed into equations by introducing slack variables. For instance, the crude protein requirement inequalities may be transformed into an equation by introducing the slack variable  $x_9$ .

$$2.82x_1 + 0.60x_2 + 2.30x_3 + 3.00x_4 + 2.53x_5 + 0.65x_6 + 0.44x_7 + 0.88x_8 - x_9 = 1$$

(The coefficients have been divided by 20 to normalize them).

A value  $x_9 > 0$  in the final solution means that it has been found profitable to oversatisfy the protein requirement.

The method of solution used was the simplex method, developed by G. Dantzig.<sup>4</sup> See Table 2 for the simplex tableau. Here the equations have all been normalized for computational purposes. For simplex calculations it is convenient to have a diagonal of + 1's beginning at the upper left-hand corner under  $P_{16}$  and extending to the lower right-hand corner under  $P_{23}$ . Such a diagonal set is not available because of the negative units appearing under the columns labelled  $P_9$ ,  $P_{10} \dots P_{15}$ . The difficulty may be easily resolved by introducing the necessary + 1's, as is done in the table under the columns headed "artificial vectors." A way of making sure that none of the artificial variables enter into the final solution is by assigning them a large unspecified positive value \$ M. Minimization of  $f$ , implies absence of the variables with which M is associated.

### Results

The results of the simplex calculations reveal that the following feed

<sup>4</sup> G. B. Dantzig, "Maximization of a Linear Form Whose Variables are Subject to a System of Linear Inequalities," USAF Comptroller, November 1949.

mixture meets or surpasses the given nutritive requirements at the least possible cost.

1. Yellow corn .....	49 lbs.
2. Wheat bran .....	13 lbs.
3. Soybean oil meal ....	35 lbs.
4. Steamed bone meal ..	3 lbs.
	—
	100 lbs.

The price of this 100 lb. mixture of feed ingredients using 1952 wholesale prices at Chicago would be \$3.81.

Also, the simplex solution tells us directly which given requirements are surpassed and by how much.

They are:

Requirements	% in excess of requirement
1. Crude protein	11%
2. Phosphorus	55%
3. Arginine	29%
4. Lysine	28%

Table 3 shows in detail just how much of each of the given nutritive requirements, which were not put into the problem explicitly, is satisfied. Thus we see that all of our nutritive requirements, except methionine, are either met or surpassed. The balance of methionine requirement can

TABLE 3. PERCENT OF NUTRITIVE REQUIREMENTS MET BY MINIMUM COST DIET

Nutritive Requirement	Percentage of Requirement Met by Minimum Cost Diet
1. Crude protein	111
2. Calcium	100
3. Phosphorus	155
4. Arginine	129
5. Lysine	128
6. Methionine	91
7. Tryptophane	100
8. Isoleucine	170
9. Leucine	132
10. Phenylalanine	119
11. Threonine	133
12. Valine	129
13. Histidine	172
14. Cystine	110
15. Tyrosine	118
16. Glycine	175
17. Fiber	100
18. Weight	100

be met by a supplement. The additional cost of this would be \$0.12 per 100 lbs. of feed. Using 12/55 feed prices we find that the minimum cost ration is the same as above. This ration would cost \$2.43.

The International Business Machine Co. now has a code for their 650 data processing machine that will handle a matrix containing up to 1,400 elements. We have solved the broiler ration problem on this machine in approximately 10 minutes of machine time.

## LAND TENURE SITUATION AROUND THE WORLD\*

Chairman: Joseph Ackerman, Farm Foundation

### BASIC ELEMENTS IN THE WORLD LAND TENURE PROBLEMS

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#### I

LAND tenure policy is today an issue in international economic policy and diplomacy. American economists and technicians have become involved in this new wave of world-wide interest in land tenure problems principally through their participation in international technical assistance programs, and to some extent through military governments.

Land tenure is land holding and land tenure problems center on difficulties in man's relation to land. The tenure of land is a complex institution, and is a principal ingredient in rural economy and society. The terms upon which land is held determine the way farm income and costs are distributed within agriculture. Tenure arrangements are therefore a critical mechanism for the shaping of labor, production, and investment incentives on individual tracts of land. In terms of the general social structure, tenure status is the principal hallmark of distinction in land based economies. The title of freeholder is still a badge of honor in parts of rural America.

Most of the land tenure reform programs in our times, in what we call the free world, have been and are piecemeal and gradual. What is being undertaken is neither the wholesale demolition of the old order to which Marxists aspire, or the transformation of the tenure structure of a country by an absolute authority. Characteristically, the leadership of a country has taken hold of their land tenure problems as, when, and where they could; and even this requires strong leadership. In India the governing party has accepted the policy of land to the tiller and has largely eliminated the zamindari type of intermediary interests in land—which were virtually an alien growth. But so far not much has been done on transforming tenants and croppers on Ryotwari (fee simple ownership) land into owners. Moneylenders have been regulated and curbed, but are still the major source of borrowing by cultivators. The Philippines have only recently enacted a law designed to purchase and distribute large estates. Efforts to date in the Philippines have been directed largely to the clarification and strengthening of tenants' rights, the encouragement

\* Joint session of the American Farm Economic Association and the American Economic Association.

of settlement, and the provision of farm credit on a limited scale. In Burma the land once acquired by the Indian Chetyar moneylenders has been nationalized. In Egypt, with the strongest program in the Arab world, the principal land reform program consists of limiting privately owned land to 200 acres of irrigated land per person, with the government acquiring the surplus and selling it to tenants at costs plus 15%. Recipients of land must agree to farm within the framework of a comprehensive village cooperative. The total area scheduled for redistribution is less than 10% of the cultivated area of Egypt. There is also a program for regulating rents on all tenancies. In Iran only the Shah's personally owned lands are being distributed to tenants. These are sold to the peasants at a relatively low price, with the proceeds turned into capital for the development bank. In Iraq, as in Venezuela, state domain lands are being improved and distributed to settlers. The recent land reform activity in Bolivia is directed to the redistribution of large estates, with many similarities to the Mexican land reform program of a generation ago.

## II

Tenure reform proposals are evoked by an almost countless number of difficulties. Many of these difficulties center in the operation of the ownership and property systems in land, consequently both the protests and attempts at reform focus upon the landlords. Comments upon these difficulties must be impressionistic; there is very little systematic research against which one can weigh interpretations. At best, we are only at the threshold of real understanding of the current world land tenure problem.

1. It is fairly clear, however, that the landlords, especially absentee landlords, are not giving leadership to agricultural development. Whatever may have been the function of landlords in an earlier era, at the close of World War II the landlords of Asia and Latin America, generally speaking, were evidently not actively interested in the management of their lands beyond attention to routine operations and the division of the crops. There are, of course, some landlords in the underdeveloped areas who are attempting to develop and manage their land and improve their villages. And it would seem wise public policy to encourage and utilize the services of these people. But one gets the strong impression that such owners are the small minority and very much the exceptions to the rule.

2. Land has acquired a market-reflected value in recent decades which it lacked in the long centuries of earlier history. This has provided an economic rent for land and consequently a basis for investment return. The insecurity and unavailability of alternative investments, other than land, have led city business men, civil servants, and politicians to acquire the ownership of land. Such owners may have also been seeking the

prestige and political power that traditionally has gone with land ownership. But whatever the motives, a very large amount of land came to be owned by people who can only be considered as pure investors when one looks at the rural economy in terms of the economics of farm management.

3. The adoption of the parliamentary governments over a large part of the world appears to have had multiple effects upon the status and function of landlords, particularly the holders of large tracts of land. These men were the *de facto* leaders of their respective areas, and their election to parliaments came naturally and surely. But parliaments meet in capital cities, and one finds many suggestions that this introduction to city life cut the tap root of the land-owning families in the outlying villages.

4. As a consequence of this complex of changes, even the capacity of the owners to manage and direct the use of their lands has gradually atrophied. I have asked informed people in a number of countries of Asia, what proportion of the landowners had any interest in and capacity for managing and improving the production practices on their land. As I recall no one has ever suggested a figure as high as 15 percent: the general belief is that the number is negligible.

This is surely a major source of the technological backwardness of the agriculture of Asia, and presumably of Latin America. On the ownership side we find the separation of ownership from direction over use, by the withering away of the latter. This also leaves investment in land primarily as the ownership of already developed properties. On the cultivator side, the traditional way of farming has continued from generation to generation, probably getting poorer with the passing decades. Under such circumstances, an economy has a very limited capacity to absorb innovations.

5. A market-oriented agricultural economy needs credit. Landlords interested and active in the management of their farms are virtually required to extend credit to their tenants, in order to protect their own interest in the crop, often from borrowed money. From this follows naturally, almost inevitably, the control over the marketing of the crop. This gives a three-way control over the economic activities of the tenant—through the tenure of land, the control of credit and the control of marketings. It would be an understatement to say that some landlords have taken advantage of this triple control to exact charges from their tenants. But the more serious exploitation is evidently to be found where the landlord is an absentee and is not active in the management of his lands. Under absentee ownerships, intermediaries and moneylenders emerge to perform necessary functions, and they have great powers of control over agriculture in the villages of the underdeveloped areas.

6. This is a time of new national states and great political ferment. Hundreds of millions of peasants are getting the right to vote—in India, Pakistan, the Philippines, Turkey, Japan and elsewhere. As the right to vote spreads, the needs, aspirations and wants of the masses of the people can scarcely be ignored. A poor and hungry man with a vote is surely undependable politically. The demands of the peasants for land of their own can be ignored only at the risk of a greater revolution. This is the significance of the political appeal in Asia of the promise of the land to the tiller; a slogan that was proclaimed by both the victorious Congress party in India and the Magsaysay group in the Philippines. An appreciation of the significance of this appeal was a basic reason back of the land reform program in Japan.

Furthermore there is the object lesson on the same point so clearly evident in Red China. In the same vein, Professor Mitrany has given us his vivid interpretation of the role of peasant aspirations for land, and the way in which the complete misunderstanding by urban intellectuals of peasant aspirations for land in Eastern Europe, helped prepare the way for the triumph of Communism.

7. The new states naturally aspire to grow stronger, and national survival requires as much. No nation can be powerful if 60 and 75 percent of her people are poverty ridden peasants. Increased strength requires both greater productivity and a more secure citizenship. The security and dignity of an honored tenure status, such as owner cultivatorship, can be a powerful instrument for helping the peasants grow into a more resourceful and productive people.

8. Lastly, there is the pressure of population on the land leading to tiny farms, particularly in Asia. The relentless search for employment depresses wages and raises rents, as economists have long observed. Land reform programs can do little to change the size of cultivating units in the densely settled countries. But they can change ownerships and the subsequent distribution of incomes.

The land reform programs of Asia which attempt to reduce rents and raise the income share of tenants or laborers are working against tremendous pressures. This is the dilemma. Under the normal workings of the land and labor markets, with increasing population pressure on the land, the share of product going to land increases and the share to labor decreases. Under the programs of welfare and social justice that the states of Asia are sponsoring in the interest of political stability, as population pressure on the land increases, the share going to land must be decreased. The politics of this dilemma is pushing the nations of Asia toward land reforms, while the economics of the dilemma is pushing

countries toward land reforms that establish owner cultivatorship in order to redistribute income. A peasant family that owns land has both the land and labor incomes as its own.

### III

The present array of land tenure proposals and programs can be best understood as a part of the development of middle class societies and economies. Such a development must be a long slow process of which we can now see only the beginnings. The tenure of land is deeply involved in this ferment. The proposals for tenure reform support the drift toward a middle class society through eliminating the remnants of feudalism and supporting the conversion of peasants into a more independent type of cultivator, a kind of middle class farmer. But the struggle to achieve anything remotely approaching a middle range income for cultivators is virtually impossible until and unless general economic development occurs. Nevertheless tenure institutions are at the core of this economic struggle, not only because rights in land are the vehicle of security and opportunity, but because tenure arrangements objectify concretely the consequences of so much of the total struggle for status and livelihood. Thus the same processes of change and development that bring the problems of the peasant to the center of political controversy, also focus attention upon land tenure arrangements.

The principal emphasis in land tenure reform programs in the underdeveloped area of the world is upon land to the tiller rather than upon improving or regulating landlord tenant relations on privately held land. The principal issues in land tenure policy can be brought into sharp focus by consideration of the feasibility of these two kinds of programs.

The general principle of the land-to-the-tiller programs is that the cultivator is placed in the position of holding land from the state rather than from private persons. This conception includes, for example, the land programs of a number of states in India and Pakistan, where with the elimination of private intermediaries the former private tenants become tenants of the state. A similar system of creating state tenancies is scheduled to take effect in Bombay state at an early date eliminating all tenancies upon Ryotwari (virtually fee-simple ownership) land. In Iraq, state domain land is allotted to settlers under a usufructuary title, granting use and occupancy rights that are permanent, inheritable, salable by government consent, but are secure to the holder only upon condition of continued use. Elsewhere in the Middle East in Egypt and Iran, in Japan and Formosa, and generally in Latin America, the cultivator gets a title more nearly approximating our fee-simple titles in land, except that the titles are usually restricted and conditional for a term of 10 to 30 years of indebtedness.

There are numerous laws and decrees in the underdeveloped countries that have the purpose of regulating tenancies by specifying maximum rents, minimum periods of occupancy, and so on. These laws undoubtedly have some effect, particularly in the cases of the most conscientious landlords. But such regulations are virtually unenforceable in situations where tenants are plentiful and poor. I have the impression also that tenancy laws that attempt to go further and give tenants permanent occupancy rights in land after some specified term of years as have been adopted in some of the states of India, actually intensify rather than reduce the insecurity of tenure of the tenant. The land is reshuffled among the tenants each year with the consequence that no planned rotation or crop improvement program is possible; or the tenants are actually pushed down the tenure scale to croppers or laborers, so that the laws do not apply.

It takes a strong government to enact and to administer effectively either a tenancy improvement law or a law designed to convert tenants into owners. In terms of popular support and satisfaction from the peasants, the case seems to be clearly in favor of eliminating private tenancies. In the Far East, particularly, it is very likely that no program of tenure reform except one that gives some promise of ownership of land to the cultivator holds any prospect of political stability. In this respect land reform is ultimately a political rather than an economic problem. If the presently constituted governments do not give lands to the tiller, they are likely to be replaced by ones that will.

Administratively, there is virtually no question but that a system of owner cultivation in which the basic distinctions between "mine" and "thine" can be marked out on the ground is much simpler to administer than a system of regulated tenancies. Unless tenants have real political rights as equal citizens, as is true in England, for example, and the administrative and judicial organizations are prepared to handle equitably a multitude of grievances, there is virtually no possibility of fair regulation of landlord-tenant relations.

There are similarly real grounds for apprehension, it seems to me, in any program that erases the distinctions between taxes and rents and blurs the distinctions between property and sovereignty as has been done in recent programs creating state tenancies. At the very minimum rents become as political as taxes, and the welfare of the cultivator becomes dependent upon effective honest public administration.

Finally, in considering the relative merits of programs to establish owner-cultivators or to improve private tenancies, the power and diversity of financial institutions can be brought to the support of programs to transfer investment and equities in land by purchase, sale and mortgage in a manner almost impossible to the shifting of rights and duties between landlord and tenants in regulated tenancies. These financial in-

stitutions were almost totally lacking in the tenure revolutions of earlier centuries.

#### IV

The test of a tenure system in terms of economic strength and survival, is to be found in the kind of performance it nourishes. One point is clear. The production performance on the farms in the underdeveloped areas needs to be improved.

The management of farms over much of these areas is routine and traditional. Under the absentee ownership pattern, the direction of even this routine operation is likely in the hands of intermediaries. How can responsive managerial capacity be developed? There is virtually no possibility of converting absentee city owners into managers. Any program that attempted to strengthen the function of intermediaries as managers would almost surely intensify social unrest and would be of doubtful productivity. The only alternative seems to be to supplement and to develop the talents of the cultivator, which is one of the necessities back of programs of supervised credit, cooperative farming and community development. If the cultivator is to be educated and his talents developed, how is this to be done? As a laborer, as a tenant, as an owner cultivator? The incentives for willing participation and the best prospects for the development of managerial talent seem to me to be found in establishing farmers as cultivators who own the land they till and all the produce therefrom.

Investment in farm land over much of the underdeveloped area of the world has been reduced primarily to a pure investment, or rentier interest. The prospects are poor for the continuance of this type of investment, due to the general lack of security of expectations for property. Furthermore such investments are limited by the very nature of agriculture in underdeveloped areas; it is not an industry that provides a pure investment opportunity.

When one turns to questions of how new investments can be stimulated, it seems clear that there must be a fusion or close coördination of the interests of ownership and use. As between inducing improvements on owner operated and tenanted land, the choice again seems to favor owner cultivators. This is due to the fact that what is needed is not so much cash investments in machinery and land improvements as the development of skills and attention to details of daily care of land and livestock. The spare time of cultivators should be invested in the improvement of their lands, their houses, irrigation ditches and drains. The opportunity cost of idleness is greater to an owner cultivator than to a tenant. The owner cultivator has more opportunities to invest his time remuneratively in both crops and the land.

## V

There are a few general principles that seem to me, in terms of tenure policy, to be of major importance for tenure adjustment programs in world agriculture. (1) The agriculture of any country is undoubtedly stronger with a variety of tenure forms than with a policy of exclusive permission to any one form. I have no doubt myself that the system of owner cultivatorship, what we call owner operatorship, is the most desirable and for most types of farming, the most productive system of tenure. However, it appears much easier to maintain a functioning system of owner operatorship where the working rules of the state permit some tenancies, and some room for investments of funds from outside agriculture. It is a question of proportions and assuring cultivators a reasonable degree of equality of economic opportunity. (2) A land tenure system is only one part of the total fabric of a society or an economy. Any tenure system that requires that the cultivator of land be manager and investor as well as laborer, must have strong supporting institutions for farm credit at reasonable terms, as well as marketing and educational institutions adapted to the needs of the cultivators. This is why land distribution programs alone are generally so disappointing. (3) When one comes to consider changes in tenure systems, or any other basic institutions, there is an impressive value in maintaining societies and economies as going concerns. When a society dissolves into anarchy and revolution the costs become incalculable. (4) Finally, the concern over land tenure problems in our time and the programs sponsored in the non-communist countries are the lineal descendants of the classical liberalism of the West. The programs for the establishment of independent cultivators are expressions of the beliefs that liberty is a function of property and that free men are more productive than serfs. The modern version of these principles is that a productive economy in a free society is based upon the general principle of willing participation.

## REPORT ON THE LAND TENURE SITUATION IN PAKISTAN AND INDIA<sup>1</sup>

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ALTHOUGH I have been asked to deal with Pakistan and India, my experience on the subcontinent has been in Pakistan. Some information on India has been furnished me, but not enough for me to feel competent to make detailed statements about India. When the quality of my information permits, I will make some statements about India.<sup>3</sup>

Land tenure arrangements in Pakistan do not follow any uniform pattern. They can be grouped into three categories:

- (1) Large estates owned by individual landlords. The village population consists mostly of tenants who cultivate the land.
- (2) Peasant proprietors with small holdings that they cultivate themselves with the help of their family or hired workers.
- (3) Ryotwari. Under this system land is held directly from the state on a tenancy basis but security is fully guaranteed. The occupant is free to give up any land and avoid his liability for land revenue. The ownership of commons is vested in the state and not in the village communities. The occupant enjoys heritable and transferable rights. Ryotwari holdings may be very large (as they are in Sind) and there may be several kinds of tenancies under ryotwari holdings. In practice the control over the lands rests firmly in the hands of the ryotwari holders.

There are in the subcontinent private ownerships that correspond to the fee-simple ownership of Western countries. These owners exercise rather complete control over their land holdings. In other parts of the area, ultimate ownership is vested in the state. The rights of the tenant of the state may vary quite a bit but generally he has most, if not all, of the privileges that ownership would confer on him. A tenant of the state would be responsible for paying land rent as well as land revenue while an owner in fee simple would be liable only for land revenue. How substantial the differences are in effect remains to be determined

<sup>1</sup> Journal Paper No. 702 of the North Carolina Agricultural Experiment Station.

<sup>2</sup> Formerly Advisor on Agriculture to the Planning Board, Government of Pakistan.

<sup>3</sup> Most of the information on Pakistan in this paper came from the Report to the Government of Pakistan by Sir Malcolm Darling on *Labour Conditions in Agriculture in Pakistan*, (1955), and the various published reports on land tenure. Information on India came from the *Five Year Plan Progress Reports* for 1953-54 and April-September 1954, prepared by the Planning Commission. My opinions in regard to the Pakistan situation have been influenced and sharpened by discussions within the Planning Board, Government of Pakistan, especially those with Mr. M. A. Khoja, Mr. Shafi Niaz, and Mr. Zahid Hussain. The responsibility for inaccuracies or omissions is mine.

conclusively. Some owners and occupancy tenants of the state-called jagirdars—are not even required to pay land revenue.

Tenants are generally of two types—"occupancy tenants" and "tenants-at-will." In practice, the former enjoy substantial rights including security of tenure, while theoretically tenants-at-will have security of tenure only for one year. Actually tenants-at-will can usually be ejected at the whim of the landlord, regardless of laws or rules. After some of the tenure legislation was passed, some cultivators who had enjoyed all the rights of occupancy tenants found it difficult to prove their claim to this preferred

TABLE 1. RELATIVE SIGNIFICANCE OF VARIOUS TYPES OF CULTIVATORS IN PAKISTAN

Province or State	Cultivated area (acres)	Percentage cultivated by			
		Peasant proprietors	Occupancy tenants	Tenants-at-will	Others
East Bengal	34,000,000	— <sup>3</sup>	— <sup>1</sup>	— <sup>1</sup>	— <sup>1</sup>
Punjab	17,000,000	35	6.7	56.0	2.3
Sind	8,600,000	— <sup>2</sup>	— <sup>2</sup>	— <sup>2</sup>	— <sup>2</sup>
N.W.F.P. <sup>2</sup>	2,700,000	40	10.2	47.0	2.8
Others	— <sup>4</sup>	— <sup>4</sup>	— <sup>4</sup>	— <sup>4</sup>	— <sup>4</sup>

<sup>1</sup> In East Bengal there are reported to be 1,702,000 tenure holders, 9,372,000 tenancies and 3,106,000 subtenancies. The average tenancy is 1.85 acres and the average subtenancy 0.69 acres. The average holding for agricultural families has been estimated at 3.94 acres but 47 per cent of these holdings are less than 2 acres each. It has been estimated that 72 per cent of the area is cultivated by owner-cultivators or tenants while the remainder is cultivated by sharecroppers (about 19 per cent) or agricultural laborers (9 per cent). The sharecropper generally gets about one-half of the produce.

<sup>2</sup> In Sind, it is reported that small holders with 100 acres or less have only 1.5 million acres while big zamindars hold more than 6 million acres. There are 294 persons who hold 5,000 acres or more while 124 jagirdars have 1.1 million acres.

<sup>3</sup> N.W.F.P. stands for Northwest Frontier Province.

<sup>4</sup> Units not covered by these tables are Khairpur, Baluchistan, and Bahawalpur. Bahawalpur tenures are somewhat similar to those of Punjab but there are virtually no occupancy tenants; Khairpur is similar to Sind; Baluchistan has a system based on the tribal life that is still the dominant social, political, and economic force.

status. Many tenure arrangements had not been recorded properly while even correct records could sometimes be altered.

Table 1 gives some indication of the relative importance of different kinds of tenure systems in Pakistan.

In the pre-British period some of the landlords in some sections of the subcontinent (especially in Bengal) had been intermediaries and functioned as revenue collectors. The British conferred ownership rights on them.

Land owners in West Pakistan are descended directly or indirectly from those who were occupying the land at the time of British conquest. Large owners had achieved their position in several ways. On border areas adventurers were able to occupy large areas where they dominated

the cultivators but gave them protection in return. Many large estates were awarded by the British to their supporters in the struggle for power. Occupants in some cases were descendants of regional chiefs who held political control over large areas and who gradually acquired the status of large landowners.

There seems to be fairly general agreement in India and in Pakistan on the particular types of land tenure changes needed. These are:

- (1) Abolition of intermediaries.
- (2) Scaling down of rents.
- (3) Security of tenure.
- (4) Grant of rights to tenants to purchase their holdings.
- (5) Ceiling on holdings.
- (6) Prevention of subdivision and fragmentation of holdings.
- (7) Consolidation of holdings.

However, these steps are not of the same order of importance. Getting land into the hands of the cultivators is by far the most important change needed. Placing reasonable ceilings on holdings will help make land available for distribution to cultivators and continuance of the ceiling will insure that a maximum number of cultivators cultivate their own holdings. Ownership holdings and tenant units need badly to be consolidated, subdivision below a certain size and fragmentation need to be prevented. Even before cultivators can be made owners, intermediaries need to be abolished, rents to be scaled down, and efficient cultivators made secure in their tenure. There seems to be a place for some renting of land to continue, especially as a step to ownership for landless but efficient farmers.

In general, what has been happening in the land tenure on the sub-continent can be discussed by addressing ourselves to two types of questions.

First, what are the ultimate land tenure goals of India and Pakistan? Toward what sort of pattern of land tenure are these two countries moving?

Second, what steps have been taken to reach these ends? Most of the steps taken have been in the form of legislation. Thus this question resolves itself into (1) what land tenure legislation has been passed, and (2) how effective has been the enforcement of the legislation enacted.

The ultimate goal in both countries appears to be to place the control of farm units in the hands of the cultivators. Policy pronouncements by responsible officials, and the tenor of much legislation confirms this goal. Whether the ultimate goal will be to have peasant ownership in fee simple as in this country or to have the cultivator as a tenant of the state, but with virtually all the rights of owner (except the responsibility for paying

land rent to the state) has not been finally decided. Immediately, the most likely aim seems to be to make the cultivator into a tenant of the state by eliminating the rights of landlords and intermediaries. Recently, voices have been raised in support of fee-simple ownership, partly on theoretical grounds and partly out of state experience in collecting rents from cultivators.

I shall discuss enactment and enforcement of legislation in Pakistan under the headings of the seven types of tenure changes mentioned earlier.

*Abolition of intermediaries.* In Pakistan, only in East Bengal has a law been passed that is specifically intended to do away with intermediaries, although in the other provinces laws have been passed that have had the effect of discouraging intermediaries. Legislation to wipe out all except military jagirs has been passed in three provinces of West Pakistan, Punjab, N.W.F.P., and Sind. East Bengal laws provide for abolition of intermediaries who are to be compensated according to a sliding scale multiple applied to the income to which intermediaries were entitled. Due to shortages of personnel and funds, even in East Bengal the reforms have been carried through in only a small proportion of the districts.

*Scaling down of rents.* Here we include not only the laws and rules governing the division of product between landlord and tenant but, what is of equal importance, the question of who is responsible for furnishing different production inputs.

Again, some of the states and provinces have passed some sort of legislation limiting the rents that can be collected from tenants. For understandable reasons, enforcement has not been singularly effective. In some localities, the reaction of landlords to such laws has sometimes resulted in making tenants worse off than before. In Sind the haris operate on a produce-sharing arrangement. By law, the hari may pay no more than  $\frac{1}{4}$  per cent of the gross produce to the landlord who pays land hari. Punjab law set the minimum share of the tenant at 60 per cent of the total produce, with the tenant to pay not to exceed 60 per cent of the taxes.

One of the more degrading features of the tenure system is the almost universal custom of levies or assessments (in cash or in kind) on the tenant and of requirements of free labor for the personal use of the landlord. Sind law has abolished abwabs (levies) and proscribed free labor. Punjab has exempted tenants and other landless villagers from levies, assessments, or provision of free personal services.

In Sind, the landlord may be asked by the tenant to furnish seed.

*Security of tenure.* The legislatures that have attempted to deal with this problem have passed laws designed to convert occupancy tenants into owners (or what is *almost* the same thing, tenants of the state), and to raise tenants-at-will to the status of occupancy tenants. Considerable

progress has been made, but here too results have not all been positive. Cultivators who had had the de facto position of occupancy tenants found themselves ejected after the legislation because of incomplete or altered records. Tenants-at-will who meet the requirements for becoming occupancy tenants sometimes find it hard to prove their eligibility.

In the Sind tenants who have personally cultivated 4 acres or more (these need not be the same acres over time) for the same landlord for 3 years or longer are supposed to have security of tenure. If he cultivates the same land, he has permanent rights on the plot of land. Even though shifted from one plot to another over time, such a tenant is entitled to a family holding. The plot to which the rights of a permanent tenant (that is, a family holding) apply may not exceed what can be cultivated with one pair of bullocks. The rights of a permanent tenant are to be inherited by only one male lineal descendent selected by the family. Tenants-at-will are all other tenants and they have security for one year.

In N.W.F.P. provisions were made for converting occupancy tenants into owners while all other tenants were given security of tenure for 3 years. Sharecroppers were not considered to be tenants under East Bengal law.

Punjab has passed laws to give immediate relief to tenants ejected since June 1949 and to protect tenants-at-will against ejection by requiring that they could be ejected only for specified reasons.

In connection with all these attempts at reform by legislation, the cultivators have all too often not been sufficiently acquainted with their rights under the law. Even when cognizant of his rights, the cultivator is often in no position to demand justice. Those responsible for meting out justice are usually from the same social class as the landlords and are often reluctant if not opposed to seeing strict enforcement.

*Grant of rights to purchase holdings.* Again, three provinces have enacted some legislation in this direction. There are variations in the criteria for eligibility to purchase, based on length of time the cultivator has been cultivating the unit. The quantity of land that he is entitled to purchase is a joint function of the acres he has cultivated and the proportion of the net product paid as rent. In every case the cultivator pays something for the unit. The amount paid as a proportion of the market value of the unit varies considerably as does the amount received by the landlord. In a majority of cases the landlord is paid less than the market value. The "price" is usually based on net product or land revenue (land revenue is supposed to bear a positive relation to net product). In some cases the purchaser pays less than the landlord receives.

The N.W.F.P. set up provisions for converting occupancy tenants into owners. Those tenants who paid no rent became owners without payment;

occupancy tenants who paid cash rent had to pay ten times the annual rent, while those who paid produce rent received a proportion of the land according to their share in product. In N.W.F.P., 241,831 occupancy tenants have become owners, while 104,000 more who paid rent in kind will become owners shortly. The units of the occupancy tenants who became owners are very, very small. Punjab law made similar provisions and committed the government to advance loans to the tenants, but little credit has been made available..

In Sind, a system to better the conditions of haris (tenants-at-will) was initiated in 1932. These "harap grants" are made to landless laborers. During the first 5 years, these grantees are considered to be tenants-at-will and pay rents (at concessional rates) and land revenue. After that, he pays for the land in installments (at concessional rates) over a 15 year period. The grantee must reside on the land and cultivate it personally. So far about 85,000 acres have been distributed and there are provisions for large tracts in the Lower Sind Barrage Area and the Upper Sind Barrage Area to be used in this way. Originally harap grants were 16 acres but became 24 acres in 1944.

According to East Bengal law, land can be transferred by a ryot only to a cultivator.

The prospective purchaser has usually encountered some difficulty in establishing his legal right to purchase. This is, of course, due to the powerlessness of the tenant vis-a-vis the landlord. Even when the tenant is able to establish a clear right to purchase land, he may not be in a position to do so. The most important obstacle is credit. The terms of purchase have not been liberalized sufficiently to enable all eligible tenants to become owners.

*Ceiling on holdings.* As a principle, this is generally accepted. Controversy rages over the details. Two serious difficulties exist; even within a small area, the differences in potential productivity of an acre are tremendous (contrast an irrigated acre on which three crops a year can be grown with an acre on a dry land farm or an acre of range land); no satisfactory data exist for classifying land or deciding what sizes of unit would have approximately the same income productivity. Even when satisfactory limits can be established, the administrative problem of taking the land from landlords, compensating them, getting the land into the hands of cultivators, collecting payments, and so on will be tremendous. Progress will have to be made very slowly.

East Bengal law set a ceiling on present and future holdings of 100 bighas per family (or 10 bighas per family member, whichever is larger; 10 bighas = 3 acres, approximately). N.W.F.P. law sets no ceilings on holdings.

Punjab law fixed 50 irrigated and 100 unirrigated acres that landlords might reserve. All above that is to be let out to tenants. The landlord need not cultivate reserved lands with his own hands; he may continue to have a tenant but the landlord's rights on this "reserved" portion are unrestrained. Tenant units may not be larger than 25 acres without permission of the government.

*Prevention of subdivision and fragmentation of holdings.* In the long run, the effective implementation of this will be of tremendous importance in stimulating productive efficiency. Again the difficulties are manifold, for the same reasons given for establishing a ceiling on holdings. The initial problem is to establish reasonable limits. Enforcement poses another difficult problem. In Muslim communities, alternative systems of inheritance will have to be developed (as in Egypt) in order to prevent holdings smaller than the minimum. Fragmentation should be somewhat easier to prevent, but prevention will mean that technical assistance will have to be made available to families in order for them to divide the land equitably without fragmentation.

In Sind, a zamindar may not sell or mortgage his land so that his holding falls below 300 acres—nor may a cultivator or small landholder mortgage his crop for more than a year in advance. The law sets a time limit on the control of land by a mortgage through a usufructuary mortgage.

A few provinces have passed legislation dealing with this problem but there has not been enough time to accumulate much experience in enforcement. Effective enforcement will depend on institutional changes.

*Consolidation of holdings.* Undoing the fragmentation that has taken place over centuries is another prime need. Productive efficiency would be increased on existing units while consolidation of undeveloped holdings would contribute to their development. At least three of the larger provinces have enacted legislation and two of these have commenced consolidation operations. Laws differ. In some units consolidation started out to be completely voluntary while in others 51 per cent of the owners could impose it on all; in some units the operation is initiated on the request of villages while in others, government decides where and when. In some places the revenue department carries out consolidation while in others the cooperative department is responsible and in at least one province both agencies are working on the problem. In East Bengal two-thirds of the ryots representing three-fourths of the cultivated area can request consolidation that is binding on all ryots, but this is not to be enforced until all the rent-receiving interests have been acquired by the province. In Punjab 51 per cent of the landowners holding 51 per cent of its cultivated area can apply for consolidation that is binding on all.

In terms of the magnitude of the task, much remains to be done, but

a start has been made over a wide front and valuable experience has been accumulated. There is good reason to anticipate even more rapid progress in the future.

In a move that is supposed to accelerate all types of land reform measures, Sind has set up special tribunals for deciding disputes between landlords and tenants.

The foregoing statements about land tenure in Pakistan have dealt largely with East Bengal, West Punjab, Sind, and N.W.F.P. Little has been done in Bahawalpur, Baluchistan, and Khairpur, partly for political and administrative reasons, partly because the problems are not so acute, and partly because the problems (at least in the case of Baluchistan) are more complex. The amalgamation of all administrative units in West Pakistan into one province should hasten and facilitate improvements in land tenure.

In general, the states of India seem to have done somewhat more with land tenure reform than Pakistan although this is not true of all states. A Central Committee for Land Reforms has been set up and works closely at the Centre with the Planning Commission and the Ministry of Food and Agriculture and with the state governments. As in Pakistan, agriculture is a provincial subject and so the major changes must come about at that level. Since May 1953 the Central Committee has considered and advised on the land reform proposals of the (East) Punjab, Mysore, Pepsu, Delhi, and H.P. governments at various stages. As part of its work of preparing a five-year plan of economic development, the Planning Commission has made specific recommendations on several aspects of land tenure reform.

There are 25 states of different sizes in the Indian Union. The situation as of a few months ago will be summarized briefly by lumping the states together roughly into different categories according to what has been done on different aspects of the problem.

Comprehensive land reform legislation has been passed in two states; comprehensive legislation is under study in six states, and a committee has been appointed in another to study the need for comprehensive reforms.

*Abolition of intermediaries.* Legislation has been passed and implemented to some extent in 17 states; legislation has been passed but not yet implemented in another; legislation has been introduced in one, framed in two others. Nothing has been done in three while administrative action in another has apparently rendered legislation unnecessary.

*Scaling down of rents.* Rents have been limited to one-fifth in one state, to one-fourth in another. Action seems to be necessary in all the others.

*Security of tenure.* Occupancy tenants' rights have been confirmed and strengthened in 12 states except on areas resumable by landlords. Tenants-at-will have not fared as well except that laws staying ejectments have been passed in 4 states. Leases are required to be registered in one state.

*Grant of rights to purchase holdings.* Full or limited rights to purchase have been conferred by law in 9 states, while in 2 states tenants and subtenants have been granted full ownership.

*Ceiling on holdings.* An absolute ceiling has been established in one state while ceilings have been placed on future acquisitions in 4 states. Bills to limit holdings have been introduced in 2 more states.

*Prevention of subdivision and fragmentation of holdings.* Legislation to check subdivision and fragmentation (by restricting partition and transfer) has been enacted and limits established in 7 states while laws permitting the state to establish such limits have been passed in 4 more.

*Consolidation of holdings.* Eleven states have passed laws governing consolidation while 6 states report some progress under these laws. In 9 states the government may initiate action for consolidation. If action is initiated by the owners, one-half of the owners representing two-thirds of the cultivated area must request in one state while in another two-thirds of the owners representing three-fourths of the cultivated area must favor consolidation.

The information available on the land tenure situation and its effects upon agricultural production and national welfare is quite inadequate. A contribution to land tenure improvement can be made by research designed to provide information on the present situation and its effects, to evaluate the effects of different kinds of reforms, and to assist progress in the whole area of rural community development.

Even radical land tenure reforms will not prove to be a panacea for all rural ills on the subcontinent. The most pressing need in both countries is to increase agricultural production as rapidly as possible; land tenure reform can play an important role, especially in providing greater incentives for tenants and owners to increase production. One of the most promising means for increasing production is to increase the investment on farms, both by the tenant and the owner, and land reform measures can result in much greater incentives for productive investments. However, it must be emphasized that land reform is a necessary but not a sufficient condition for increased production and welfare. Other requirements are:

- (a) An agricultural extension service.
- (b) A program to provide rural credit for production purposes.
- (c) Programs to provide much greater quantities of much more productive agricultural inputs.

Both countries have assigned the highest priority to their rural community development programs (community development includes, but is much broader than, agricultural extension), and are providing steadily increasing flows of development services to the rural areas.

Less progress must be reported in meeting rural credit needs, although not for any failure to recognize the importance of the problem. The magnitude and complexity of the problem are staggering. Planning is going ahead on sound lines but covering the whole of either country with adequate rural credit services will take a great deal of time and resources.

Finally, the cultivator needs better seeds, fertilizer, plant protection materials, better farm animals, better equipment, marketing services, and many other types of improved production inputs. Needs have been recognized. Considerable progress has been made along some lines, some progress along all lines.

The foregoing paragraphs have dealt almost entirely with attempts to solve the social, economic, and political problems of land tenure by means of legislation and administrative edict. In many countries of the world, education of the tenant and the landlord has been more effective than laws designed to enforce behavior in the social interest. There seems to be little sentiment on the subcontinent (except among landlords) for allowing the landlords to own land much in excess of what they can cultivate themselves. This means that education to improve landlord-tenant relationships will be useful only in the interim before tenants become owners and on the relatively few tenant units that remain. This interim may be fairly long and educational efforts might help bridge the gap. Even after changes in the basic structure of land ownership have been accomplished, there would seem to be an important role for education in helping to maintain the pattern of ownership as near as possible to the optimum. The difficulties in bringing about substantial institutional change in democratic countries where illiteracy rates are very high and where public administration has not been geared to the total welfare are tremendous. However, it is easy to exaggerate the difficulty of that part of the problem involved in raising the understanding of cultivators to the necessary level. Given an institutional environment conducive to optimum national welfare, much progress can be made.

## LAND TENURE PROBLEMS IN SOUTHERN EUROPE

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**A**LTHOUGH I should like to present a precise quantitative survey of the land tenure problems of southern Europe, I shall not do so for two main reasons. One is that statistics necessarily make a verbal dissertation boring; the second and more important reason is that I do not have many figures, and those that I do have are not sufficiently reliable. Nevertheless, I shall insert quantitative data from time to time even though they lack precision and sound dreary.

I shall talk mainly about Spain because I know most about it and because it is probably the least known Mediterranean country, as is shown by the "Study of Economic Development in Southern Europe" included in the *U. N. Economic Survey of Europe in 1953*. But if this is true, the fault lies with Spanish economists whose contributions to our knowledge of land problems have not been on a level comparable with the research done by Italian agricultural economists. On the other hand, the similarities between the economies of Spain and Italy are so many and so striking that a comparative study of their agriculture would increase our knowledge of many problems of agricultural economics, if for no other reason, because it would modify most of the analysis based on national peculiarities.

### *Economic Structure*

The above mentioned *U. N. Economic Survey* gives an excellent short description of the natural environment of the agriculture of southern Europe. "The scarcity of rain in the summer had led to a concentration on deep-rooted, drought-resisting plants such as olives, grapes and tobacco. In addition, the soil is poor, not least owing to centuries of mismanagement; soil-exhausting methods of cultivation, and the erosion caused by lack of water control, over-grazing, deforestation and the ploughing of hillsides. . . . The pressure of population has . . . led to exploitation of even the least suitable lands. . . . Despite efforts in all of the countries to promote industrialization, the phenomenon of surplus manpower in agriculture . . . has taken on even more serious proportions."<sup>1</sup>

There is as definite a contrast between the two Spains as there is between northern Italy and southern Italy. Northern Spain is not nearly as well developed as northern Italy; but southern Spain, i.e. the Mediterranean Spain, is much less underdeveloped than southern Italy.

<sup>1</sup> United Nations, *Economic Survey of Europe in 1953, including a Study of Economic Development in Southern Europe* (Geneva, 1954), pp. 100, 126 and 82.

We cannot speak of the Spanish land problem but of several different problems of maladjustment between economic resources: man, land and capital.

The "land problem" in the southwest confronts us with fairly good land, water and capital scarcity, land concentration, high percentage of seasonal farm laborers and low income levels. The problem on the central-eastern coast is characterized by rich irrigated land with extremely high productivity per acre and low productivity per capita; a very high density of population (up to concentrations of 1,200 inhabitants to the square kilometer) mainly made up of farmers who are owners or tenants, a relative abundance of small-scale industries and a fairly high standard of living.<sup>2</sup> The problem on the central plateau is one of poor land and lack of water, sparse population, mostly in family farms, with low productivity per acre and per capita and a low income level. The problem in the northwest, with rather good land and abundant rainfall, arises from a high density of population, composed of farmers who are landowners or tenants specializing in cattle production with very low productivity and a low standard of living.

TABLE I. DISTRIBUTION OF LAND OWNERSHIP IN SOUTHERN AND  
WESTERN SPAIN IN 1928\*

Size class	Number of Landowners (thousands)	Area (thousands of hectares)
Under 1 hectare	590	2,844
1 to 5 hectares	528	3,228
5 to 10 hectares	143	1,185
10 to 50 hectares	135	2,565
50 to 100 hectares	22	1,452
100 to 250 hectares	14	2,008
250 to 500 hectares	7	2,320
500 to 1,000 hectares	4	1,908
1,000 to 2,500 hectares	2	1,677
2,500 to 5,000 hectares	0.8	558
5,000 and over	0.3	429

NOTE: These data cover 27 of the 50 Spanish provinces with an area which represents about 40% of the total national territory.

\* *Memoria de la gestión de la Dirección General de Propiedades y Contribución Territorial durante el año de 1928* (Madrid: Imprenta de la Fabrica de Moneda y Timbre, 1930).

The only available data on the distribution of land ownership cover only about 40% of the national territory and include only the southern and western provinces. These data refer to 1928, but their greatest weakness is that they cover all the Spanish provinces that have large estates

<sup>2</sup> Rene Dumont, "Las dificultades de la agricultura española," *Boletín Oficial de la Asociación Nacional de Ingenieros Agrónomos*, No. 20, November 1951, p. 9. Cf. also Alice Foster, *The Geographic Structure of the Vega de Valencia*, Chicago: The University of Chicago Libraries, 1936.

and none of those characterized by the minifundia. Therefore the indexes of concentration of ownership would be entirely different, and much lower, if these statistics covered the whole country.

A recent survey is available with regard to the structure of farm management in Spain.

TABLE II. NUMBER OF FARMERS AND DISTRIBUTION OF CULTIVATED AREAS IN SPAIN, ACCORDING TO TYPES OF LAND TENURE IN 1950\*

Tenure type	No. of farmers (thousands)	Cultivated area (thousands of hectares)	Average size of farm (hectares)
Landowners	2,103	13,411	6.2
Share-rent tenants	460	2,972	6.5
Tenants (sheltered contracts)	817	1,851	2.2
Tenants (others)	359	2,841	7.8
Total	3,739	21,075	5.6

NOTE: The so-called tenancy contracts under shelter ("arrendamientos protegidos") are those established for an annual rent not above the monetary value of 4,000 kilos of wheat and with the obligation for the tenant, of personal operation of the farm.

\* LUIS GARCIA DE OTEYZA, "Los régimenes de explotación del suelo nacional," *Revista de Estudios Agro-Sociales* (Madrid), No. 1, October-December 1952. (This article includes the breakdown of the above mentioned figures according to the territorial division of Spain.)

The total number of farm laborers in Spain is probably close to three million. Owing to differences in the age limit considered and the inclusion or exclusion of married women, estimates vary widely.

### *The XIX Century*

When studying the land tenure problems in Spain, it is common to start with the conditions and the government policies of the 1920's. Actually it is impossible to understand the situation in Spain without looking back to the first half of the 19th century, when a transcendental land reform was carried out. I am talking about the huge process of disentailment ("desamortización") that took from the crown, the church and the municipalities a considerable part of the Spanish land and transferred it to individuals who either worked it themselves or rented it to others. In 1836 the great Spanish economist Florez Estrada wrote that communal waste lands, mortmain property, and entailed estates accounted for two-thirds of the Spanish territory. No matter what we may think of the political implications of this reform, the fact remains that it gave to the Spanish land tenure system a modern individualistic basis; and at the same time it started an intense process of soil erosion mainly through deforestation to grow grain.

A most interesting research project would be to ascertain the extent to which the investment in land induced by this reform, in conjunction with our previous war of liberation from Napoleon, our civil wars in

1833-1872, and our inadequate natural conditions, were responsible for the slowness of our industrialization. However, the people who at that time invested in land the profits obtained in urban areas made wise decisions. Owing to increasing population pressure and despite low productivity, the land kept the real value of the investment throughout the many hazards of the second half of the 19th century and deep into the 20th.

Better information about the causes of retardation in the process of industrialization in Spain in the 19th century might contribute to a better knowledge of the nature of economic growth. Such a research project should be a challenge for an American scholar. The difficulties of the task are enormous. But greater were the difficulties that Professor Earl J. Hamilton encountered in his research on the History of Prices in Spain from the XIV to the XVIII centuries, and he not only greatly augmented our knowledge of Spanish economic history but was able to extract original contributions to economic theory.<sup>3</sup>

### *The Agrarian Reform of the 1930's*

The inflationary effects of the First World War greatly increased the farmers' profits and gave rise to a wave of unrest not only in the urban areas but also among the rural masses of laborers in southern Spain. The peak of this period of unrest centered on the years 1918-20,<sup>4</sup> but the inflationary profits remained for a longer time. This situation provoked an increased demand for land to farm and a spontaneous trend to break up large estates. The laws of 1927 and 1928 tried to promote this trend by helping finance the purchase and break-up of estates through voluntary agreements between landowners and tenants or sharecroppers. I do not have exact data on this movement. However, it was of some significance in certain local areas of southern and western Spain before the legislation of 1927. Unfortunately, the middleman, who in many cases took the initiative, reaped handsome rewards.

The Second Spanish Republic announced, immediately after its birth, a drastic land reform. It took a little more than a year—from April 1931 to September 1932—to draft the Agrarian Reform Law and to discuss it in Parliament. But in September 1932, laborers and sharecroppers started the invasion of estates in the central-western provinces in time for sowing the grasslands. It is interesting to note that the Spanish government when giving legal character to this invasion used the same words that the

<sup>3</sup> See especially his "American Treasure and the Rise of Capitalism, 1500-1700," *Economica*, VII, 1929, pp. 338-57 and "Profit Inflation and the Industrial Revolution, 1751-1800," *Quarterly Journal of Economics*, LVI, 1942, pp. 258-73 and also his three volumes on the history of prices in Spain.

<sup>4</sup> An excellent description of this revolutionary period is to be found in J. Diaz del Moral's *Historia de las agitaciones campesinas andaluzas—Córdoba*, Madrid: Revista de Derecho Privado, 1929, pp. 281-410.

Italian government had used for a similar situation in 1919-20 (decrees of Visocchi, Falcioni and Micheli), but when I told the Spanish authorities, years after the event, about this coincidence, they admitted their ignorance of the Italian precedent. In brief, these rules gave to the invasion the nature of a temporary settlement. The workers received the operating capital in loan from the government and the government underwrote the payment of a rent to the landowners.

The Agrarian Reform Law of 1932 followed very closely the Rumanian and Czechoslovakian laws of the 1920's. It was strictly a land redistribution measure. It covered central-western and southern Spain. Practically all the land was affected by this law, but also every landowner thought that he was favored by one or more of the exemptions. Incidentally, this law, as well as the laws for tenancy regulation, to which I shall refer later, made Spain a paradise for lawyers. Every laborer, sharecropper, and tenant had some accession rights to the land within a complicated scale of priorities that gave preference (1) to unskilled laborers, (2) to farm workers' associations, (3) to small landowners, and (4) to small tenants. An indemnity to the landowner was established on the basis of the rent declared for fiscal purposes, which brought the valuation far below the market value. An absolute priority was given to workers' associations that requested land for collective farming. When the law was promulgated, the situation was as follows: no land could be expropriated because of the lengthy legal procedures, and no individual worker could be settled because in every village the Socialist Party had a workers' association to claim the prior rights for collective farming. The government used a rider inserted in the law to expropriate the Spanish grandes and to punish the landowners who had participated in an anti-Republican movement. Their land had to be expropriated without payment. Until the so-called "counter-reform law" of 1935, the land invaded in 1932 and that expropriated under the rider were the only estates that the law affected. The law of 1935, enacted under a right-wing coalition of republican parties, "tightened the reform of the land tenancy system with so many limitations and restrictions that they made it actually worthless."<sup>5</sup> Up to February 1936 the operation of the laws had affected less than 500,000 acres for the settlement of possibly 50,000 workers under a system of temporary tenancy.

Two other legislative movements during the period already considered have affected the land tenure system in Spain: the laws to promote land irrigation, mainly those of 1849, 1893, 1911, 1925, 1926 and 1931, and the laws on land tenancy, mainly the regulations inserted in the Civil Code

<sup>5</sup> From a speech by the then Minister of Agriculture, D. Carlos Rein Segura, in *La ley de expropiación de fincas rústicas*, Madrid: I. N. C. Publicaciones, No. 10A, [1947], p. 37.

of 1889 and the law of 1935. The reclamation policy based on these laws for irrigation gave some beneficial results, but it fell short of the proposed goal. The law of 1935, on tenancy, enforced and extended a downward trend in the level of rents initiated in the 30's by the glut in the markets for the main food staples (wheat, rice, wine, olive oil, sugar beets, etc.) and by the social unrest of this period. In spite of maintaining the freedom of landowners and tenants to determine rents, this law enabled the tenant to appeal against the freely determined rent if it were above the one declared for fiscal purposes. Actually, the rent levels of the 1920's have never again been reached.

### *The Settlement Program*

Since the Spanish Civil War of 1936-1939 an active legislative process affecting land tenure has started, and this process is still in the making. The aftermath of the Civil War, destruction of real capital, land depletion, and lack of raw materials, with their low productivity effects, let loose an inflationary trend that has been running since then, in some periods violently and in some periods gently. Agricultural prices were controlled and acreage quotas imposed, the last of which practically disappeared in 1951.

In attacking the land tenure problem there has been a definite shift from land redistribution to land reclamation. The law of 1939, although it covered both dry-farming areas and land capable of irrigation, was in fact only applied to the irrigable areas. The reclamation work had to be done with government help by a landlord association in each watershed or, if the landlord association refused to cooperate, by any private corporation that would apply for the privilege. The government received no significant response; so it unearthed the law of 1927 and authorized the *Instituto Nacional de Colonización* (INC) to buy the land voluntarily offered to it within the watersheds already defined for reclamation purposes. (In 1946 it had already defined 675,000 acres.<sup>6</sup>) A new and important step was taken in 1946 by authorizing the INC to purchase land by condemnation.<sup>7</sup> A new step was advanced in 1949. That year a new law authorized the INC to determine beforehand the land to be expropriated in each watershed, to establish at that time the purchase price for each parcel, and to proceed to the reclamation works before the actual expropriation took place, postponing this until the new settlers were prepared to take care of land ready to be used under irrigation. This law has been enacted to tackle the old evil of the surplus value of the land.<sup>8</sup> How

<sup>6</sup> Carlos Rein Segura, *op. cit.*, p. 45.

<sup>7</sup> Carlos Rein Segura, *op. cit.*, pp. 47-8.

<sup>8</sup> Carlos Rein Segura, in *La Ley sobre colonización y distribución de la propiedad en las zonas regables*, Madrid: I. N. C. Publicaciones, No. 12A [1949], pp. 49-53.

does this surplus value come about? As soon as the project is in a state of relative development, and the irrigation is envisaged as a reality, land speculation will appear with the strength corresponding to the hunger for good land in a period of food scarcity and high agricultural prices.

The results of the land reclamation program up to the present are demonstrated by the following tables:

TABLE III. DEVELOPMENT OF LAND FOR IRRIGATION BY THE INSTITUTO NACIONAL DE COLONIZACION\*

	Thousands of Hectares	Number of New Settlers
Before 1949	1.6	1,322
In 1949	1.0	327
In 1950	3.4	480
In 1951	3.0	787
In 1952	8.5	664
In 1953	12.5	738
In 1954	81.4	2,300 (est.)

TABLE IV. ALLOCATIONS FOR WORKS IN PROGRESS UNDER THE INC AT THE INDICATED DATES\*

January 1, 1953 .....	227 million pesetas
January 1, 1954 .....	461 million pesetas
January 1, 1955 .....	737 million pesetas

\* Source of all data in tables III and IV is the INC.

In summary, the operations of the INC up to the end of 1954 represent the acquisition of 269,500 hectares of land at a cost of 785 million pesetas and the settlement of 30,123 families on this land.

Two facts account for the delay in the execution of the settlement program. One has been the opposition of the landowners, as has already been shown, and the other the necessity of training technicians and administrators. The process has shown a significant acceleration in the past few years.

In the meantime tenancy has been the subject of specific measures that have exerted a considerable influence on the postwar agricultural situation. In 1940 rent freezing and suspension of the right to evict the tenant at the expiration of a contract was confirmed and extended.<sup>9</sup> The index of the land rent, has increased from 50 pesetas in 1939 to 200 pesetas in 1954, while the price paid for each 100 kilos of wheat has increased from 50 to 402 pesetas. This increase of the wheat price had nearly caught up with the rise of the general price level during the whole postwar period.

<sup>9</sup> On the rent-freezing mechanism and tenancy laws *cfs.* Manuel M. de Zulueta, *Derecho Agrario*, Barcelona: Salvat Editores, 1955, and Aranzadi, *Arrendamientos Rústicos*, Pamplona: Editorial Aranzadi, 1955.

A new action has been recently initiated to face the other versant of the land problem in Spain, i.e., the consolidation of fragmented holdings. Fragmentation dominates large areas in central and northwestern Spain. Farms are broken into hundreds of small plots separated from each other, thus making any technological progress impossible. This situation is the result of partitions among heirs, generation after generation. Cases such as the farmer in the province of Guadalajara who owns 70 acres in 394 separate plots are neither imaginary nor exceptional.<sup>10</sup> The law of 1952 and subsequent decrees are already showing the first beneficial results.

Two forces are helping to carry forward the settlement program; the inflationary trend and rent control. The policy of cheap money has facilitated financing; the price inflation has made it easier for the settlers to amortize the operating capital; the food scarcity has offered a ready market for the products believed to be best fitted for the success of the settlement. Rent control has made it less desirable for capitalists to keep their investments in the form of land and has permitted small tenants to accumulate financial reserves that will be very useful in the future expansion of this project. But in spite of everything, land has remained a hedge against the risk of inflation; because the landowner believes that some day he will recover full possession of his land and that at that very moment its price will adjust to the general price level, as it always has in the past.

The period ahead of us will witness the effects of two obstacles to the expansion of the settlement program: a rapid increase in its financial burden on the government, and the change from a sellers' market to one of surpluses in all vital food staples (grain, olive oil, sugar, wine, etc.). The crucial issue that sooner or later will confront any land tenure reform, if not limited to mere land redistribution, is how to find a market for the increasing production or what to produce on the improved farms.

### *The Land Question*

In predominantly agrarian countries the land represents two different goods and has two markets of different nature: land as a productive input and land as the main support for a definite way of life. As a productive input land can be increased by technical improvements. But the high cost of increasing the land productivity, either by augmenting the operating expenses, or by irrigation projects, requires a shift toward products such as livestock, fruits, and vegetables, that most of the population cannot afford to buy. So agricultural development, in isolation, soon falls short of its target by making the land redundant for lack of markets and rapidly reducing the marginal productivity of capital investments.

<sup>10</sup> Cfr. Ministerio de Agricultura—Instituto de Estudios Agro-Sociales, *El parcelamiento de la propiedad rústica en España*, Madrid, 1952.

In agrarian countries, land as the main support for rural life is and must remain scarce. When population pressure induces low productivity per capita, in other words when the necessities of life (grain, potatoes, fats and wine) are scarce, the land becomes supreme for both life and social prestige. The agrarian reforms that consist merely in land redistribution fail to solve the "land question" because there can never be land enough for all the land-hungry people.

Both types of measures, agricultural development and agrarian reform, are difficult to coordinate because they demand different tempos. Agricultural development requires a "moderato" due to the limitations of the flow of available capital. The agrarian reform demands an "allegro" that in southern Europe easily breaks loose in a "vivacissimo"; otherwise it will clash with its political motivations. Moreover, if the agrarian reform rapidly attains its short-term political goals through a land "atomization," to accommodate the millions of persons who want land, low productivity and lack of effective demand for expensive foods and for industrial commodities will perpetuate a situation of poverty and population pressure.

The usual approach to the problem is to say that in the predominantly rural countries (1) population is undernourished and (2) that in spite of the niggardliness of nature in these countries there is still an ample margin for the application of modern techniques. "To sum up," says the UN study of southern Europe, "an increase in the volume of agricultural output, and a concomitant change in its composition towards greater livestock production is necessary in order both to reduce the dependence on food imports and to make possible a much needed increase in standards of living."<sup>11</sup> And, according to this report, the obstacles to this change are not of a technical or economic nature, but are related to "the social structure of agriculture, the poverty of farmers and the technical inertia of a largely illiterate farm population."<sup>12</sup> All this is evident, but it has not been proved that the increment of this type of food will be achieved at price-cost relationships that can compare with those achieved in the production of staple food and fibers.

The situation of American agriculture today is the best proof that the most advanced techniques added to a real abundance of natural resources is not enough to change the structure of agricultural production, shifting it from staple foods and fibers toward protective foods and grasslands. To be fair to the UN economists, I must say that their survey emphasized industrialization as the ultimate solution. "In countries such as those of Southern Europe, where a large share of the agricultural

<sup>11</sup> United Nations, *op. cit.*, p. 102.

<sup>12</sup> *Op. cit.*, p. 161.

population is really unproductive, the necessity for a large transfer of manpower to industry is especially evident."<sup>13</sup>

That the agrarian question is a complex problem that has no simple solution is too evident to be emphasized here. But I believe that in this case the difference between success and failure depends more than in any other on timing and on priorities. The question of priorities in the development of different sectors is an essential issue for economic policy in southern Europe. I shall limit myself here to mention Ragnar Nurkse's study on underdeveloped countries, in which he stresses the importance of a balanced growth. "The private inducement to invest in any single project may be quite inadequate because of the market difficulty, even where the marginal productivity of capital applied over a range of complementary industries . . . is very considerable. This is why a wave of new investments in different branches of production can economically succeed, enlarge the total market and so break the bonds of the stationary equilibrium of underdevelopment."<sup>14</sup>

If I may single out the two things I should put first, they are electricity and rural wages. Abundance of energy is much more important for life today than we living in the midst of plenty, can realize. The external economies that electrical power plants diffuse are the most important single factor in economic development.<sup>15</sup>

A policy of keeping agricultural wages going up so fast as possible will favor farm mechanization and raise aggregate demand by displacing laborers who will migrate to urban areas and increase their consumption. But this high-wage policy requires the creation of new opportunities for employment in industry and services. For it is a primary duty to avoid hardships. The first goal of the economy is the pursuit of happiness for every individual.

The speed and direction of this over-all population transfer and opening of new occupations will in the end determine whether or not the future economic growth is sound. To make this growth possible agrarian reform and agricultural development are both necessary. However, if this pace will point toward building a few gigantic cities, or will promote a consistent addition of urban features to the nation's life, also depends on forces that lie outside the framework of economic policy.

<sup>13</sup> *Op. cit.*, p. 182.

<sup>14</sup> Ragnar Nurkse, *Problems of Capital Formation in Underdeveloped Countries*, Oxford: Basil Blackwell, 1953, p. 15.

<sup>15</sup> Cfr. E. A. G. Robinson and G. H. Daniel, "The World's Need for a New Source of Energy"; paper read at the Geneva International Conference on the Peaceful Uses of Atomic Energy, in August 1955.

## LAND TENURE IN AUSTRALIA IN RELATION TO TECHNICAL ADVANCES AND CLOSER SETTLEMENT

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THE NATURE of Australia's land tenure problem differs materially from that of many older settled countries. In the relative absence of population pressure, subdivision of production units has not advanced to the stage where consolidation of fragmented holdings is a widespread need, nor even to the point where the general size range does not permit the introduction of efficient mechanization. On the other hand, landlordism has not manifested itself in such a way as to create widespread persistent pressure for land reform. Nevertheless, the past history of closer settlement reveals many failures through the creation of production units too small for survival in an economy so exposed to the effects of fluctuations in the export prices for primary products.

There are still some very large farm or grazing holdings in Australia being used extensively or semi-extensively that are suitable on the basis of modern technology for far more intensive use. These pose a problem in so far as Australia needs to expand her export earnings in order to support growth, while at the same time she has to meet the consumption requirements of a population expanding at the rate of around 2½ per cent per annum. To appreciate the nature of the problem, some general knowledge of the Australian system of land tenure is necessary.

Under the Australian constitution land policy has remained in the hands of the states. As a result there is considerable variation between the six states, whilst in the Commonwealth administered territories (the Northern Territory and the Australian Capital Territory) conditions are for the most part different again. The attitude towards freeholding and leasing differs materially, and the conditions of tenure also vary. One general principle has been followed with some consistency, and that is the policy of not alienating the arid interior where the balance between vegetation and animal can be so easily disturbed.

As at the end of 1953, only 7.98 per cent of Australia's 1904 million acres had been alienated, i.e., had been allowed to pass from the Crown into private hands, a further 1.75 per cent was in process of alienation, 53.34 per cent was leased or licensed and 36.93 per cent was unoccupied.<sup>1</sup> The percentages differ markedly among states. In Victoria, the percentage alienated is 54.58 per cent, in New South Wales 26.05 per cent, whilst

<sup>1</sup> Most of this is comprised of the desert interior. However, there are also some Crown lands within the more favored rainfall areas which, for a variety of reasons such as unsuitability for settlement, have never been alienated nor leased.

in the states of South Australia, Western Australia and Queensland, the percentage alienated varies from 3 to 6 per cent. This is not due entirely to a difference in attitude toward the alienation of land—although present Victorian policy is in that direction—but also to the fact that the percentage of arid land in Victoria is lower than that in the other states. In the recent postwar period of closer settlement under government auspices,<sup>2</sup> Victoria is the only state that has offered freehold conditions to new settlers, either on predeveloped Crown land, or on properties acquired and subdivided for the purpose of closer settlement.

There is a considerable range in size of holdings devoted to the more important rural enterprises in Australia of cattle and sheep raising and grain production. However, deductions in relation to the scope for closer settlement should only be made after due consideration of the wide range of climatic conditions within which these activities are pursued. Only one-third of Australia is suitable on climatic grounds for intensive agriculture; one-third is semiarid and suitable for pastoral and grazing activities on an extensive basis; the remaining one-third is climatically unsuitable for occupation for either purpose. Until comparatively recently it was generally believed that a big proportion of the climatically suitable one-third could not be developed economically for intensive agricultural production, on account of soil infertility and the cost of clearing and development. Recent technological advances have now changed this belief. Except for the limited proportion still held as Crown land, existing conditions of land tenure present a barrier to rapid intensification of land use through closer settlement.

From available statistics it is not possible to make a reasonable estimate of the proportion of occupied land held in parcels appreciably in excess of a home maintenance area.<sup>3</sup> In 1947-48, the last year for which a frequency distribution of Australian holdings by total area is available, 58% of the total area of rural holdings (excluding the Northern Territory) was occupied by individual or company holdings of more than 100,000 acres, while about 85% of the total area was in holdings of 5,000 acres or more. It must be remembered, however, that many of these large holdings are not excessive due to the extremely sparse grazing in the arid interior and to the climatic hazards involved.

<sup>2</sup> Most closer settlement in this period was within the provisions of the War Service Land Settlement Agreement Act of 1945.

<sup>3</sup> The basic concept of closer settlement in Australia, namely a home maintenance area, may be defined as that area of land which, when developed and operated in accordance with existing technology, will provide the operator with a reasonable level of living after meeting all his commitments. In the case of War Service Land Settlement the commitments assumed in determining a home maintenance area are those of an ex-serviceman with no capital of his own to invest, that is, they include repayments of principal over a specified period.

A comparatively recent estimate in relation to beef and sheep raising and wheat production shows the following:

- (1) Around 10 per cent of the beef cattle of Australia are carried on holdings of less than 1,000 acres in size; around 50 per cent are carried on holdings ranging in size between 1,000 and 50,000 acres; whilst 33 per cent are carried on holdings in excess of 100,000 acres in size. The largest cattle station is 11,262 sq. miles in size.
- (2) Around 50 per cent of the sheep in Australia are carried on holdings under five thousand acres in size, many of them being on mixed farms which produce grain on a commercial scale; a further 12 per cent are carried on holdings ranging in size between 5,000 and 10,000 acres; whilst the balance is carried on holdings of a size greater than 10,000 acres.
- (3) Around one-quarter of the wheat produced in Australia is from holdings of less than 750 acres in size; more than two-thirds is grown on holdings within a size range from 750 to 5,000 acres; whilst around 7½ per cent is grown on holdings within the size range of 5,000 to 20,000 acres.

Major technological developments in the past two decades have made possible the more intensive use of land both in the arid pastoral and grazing areas and in the better rainfall zones. These are as follows:

- (1) Mechanical techniques of constructing deep surface water catchments and earthtanks, that will not be exhausted by evaporation in the frequently recurring protracted dry periods. This has brought the possibility of water security to those hazardous regions that do not lie within the Artesian basins.
- (2) Economical large-scale mechanical land clearing techniques.
- (3) Successful large-scale aircraft spraying. Killing of scrub with hormone solutions.
- (4) Advances in techniques of dryland farming including cultural methods of subsoil moisture storage and the use of high-powered machinery which permits the timing of critical cultural operations.
- (5) Spectacular discoveries of the means of overcoming mineral deficiencies in the extensive areas of poor soils of the higher rainfall areas together with advances in the adaptation and management of legume-based pastures.

Estimates of the areas of Australia now capable of development to intensive introduced pastures and of intensive cropping, range between 150 and 250 million acres, compared with the present area of around 50 million acres.

In parts of Australia early land policy appears to have anticipated technological development. Land was leased for periods of twenty-five or thirty years, with appropriate resumption rights. However, technical developments can be said to have outstripped the land tenure system in some important regions. The most notable potentially productive region to which this applies is the brigalow belt.<sup>4</sup> It is estimated that some 14

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<sup>4</sup> Brigalow, which is the dominant species in the plant association so described, is an acacia (*A. harpophylla*).

million acres of highly fertile land now under brigalow scrub, and carrying a comparatively small population of livestock, could be cleared and developed under modern techniques for an intensive combined cropping and grassland use. Most of it is at present leased for extensive grazing purposes in areas several times the size that would be required for home maintenance purposes on an agricultural or cropping improved pasture basis. Most of the brigalow land is in Queensland. However, in the states of New South Wales, Victoria, and, to a certain extent South Australia, there is a big acreage in large estates, which is not being used intensively in the way that modern technology of improved pasture establishment and management would permit.

Two questions that might well be raised are:

- (1) Is there a need for accelerating the rate of application of modern technology, production and land use?
- (2) What measures are being or can be employed to overcome the barriers imposed by existing land tenure?

A positive answer to the former question stems naturally from an analysis of what export earnings are required to finance the imports essential to support Australia's growth, and to maintain present levels of living. It is a very ambitious undertaking to maintain a rate of population increase around 2½ per cent through an immigration programme of the magnitude of the past few years. The brunt of the task of meeting increased domestic consumption and of financing import requirements must continue to fall upon Australia's primary industries, which traditionally have been responsible for around 90% of export earnings. Without any further adverse change in the terms of trade against producers of primary products, and no or little reduction in per capita requirements, the rate of increase in the volume of production that would have to be maintained presents a very formidable task indeed. Sustained capital inflow at a sufficient rate cannot be expected to bridge the gap between realised export earnings and what is required to finance an adequate flow of imports. Leaving aside the question of world markets for increased production the requirements can be met by maintaining a sufficient rate of increase in rural production.

A second objective of accelerating the rate of application of modern technology relates to the moderation of the fluctuations due to drought. The extension of water security to the semiarid regions where much of the grazing and pastoral industries are located can achieve much in this direction.

Relating to the question of land tenure as a barrier, it is conceivable that large landholders in areas affected by the new techniques might fully develop their properties. However, there are a number of social and eco-

nomic factors that have a major bearing upon their attitude. A very strong factor is the grazing outlook. In the past there has been a social prestige attached to being pastoralist, a grazier or a "squatter," as distinct from a farmer or "cocky." Older members of the "squattocracy" are naturally adverse to suggestions that they should change their way of life and adopt the production methods of the "cocky" farmer or tiller of the soil. Many believe that if they commercially exploit the intensive production techniques available, it will hasten the incidence of resumption policy including the declaration of the region as agricultural, not purely pastoral or grazing. In some cases, where attempts to coerce holders of large tracts of freehold country into selling appreciable proportions of their land to the government for subdivision and closer settlement, the argument has been regularly put forward that a large area is necessary to maintain a stud flock of merino sheep efficiently.

The need for breaking up large holdings is nowhere more apparent than in the Northern part of Australia where most of our beef cattle are carried. Several very large holdings are operated exploitatively in the financial interests of remote shareholders. This is a legacy of the old colonial system that runs counter to the requirements of decentralized economic development and increased population. The station may be run by a manager whose scope for local spending or investment in property improvements, including the housing necessary to attract resident families to the region, is severely restricted. Subdivision into units of management each occupied by a resident manager with family appears to be an essential first step towards justifying additional public expenditure on railways and amenities within this region. Servicing industries would then follow and the sequence could lead to a reversal of the past trend of declining population within the region.

The most direct measure to overcome the tenure barrier to intensive utilization of suitable land has been the government-sponsored closer settlement scheme for ex-servicemen. At the end of World War II it was possible to persuade and coerce holders of large tracts to sell appreciable proportions of their land for settlement of ex-servicemen. However, as time went by and wool prices rose it became increasingly difficult to arrange purchases without a degree of compulsion that the government of the day was not prepared to exert. Furthermore, the costs of placing each individual on a new holding under the ambitious conditions of settlement had become very high. As a result there is now very little land being acquired for bringing within the scheme. Generally speaking, those settled have been settled well; the conditions of the act ensured this. Great care was exercised regarding the estimation of suitability for a particular land use. Subdivision was based on careful budget estimates

in regard to which long-term prices for primary products were conservatively estimated. There was predevelopment of holdings and plans with credit available for rapid extension of development to the point at which the holdings were comfortable home maintenance units. Where necessary capital costs of development were written down.

Up till the end of fiscal year 1955, 14 million acres had been approved for inclusion in the scheme, which will provide 8,134 holdings. Total expenditures and outlays by Commonwealth and states since the inception of the program have amounted to £112.5 million (approximately \$250 million).

Recently, attention has been directed towards accelerating more intensive use of land by other measures. In Queensland, for example, much of which is at an earlier stage of development than the southern states, a dynamic view is taken of the area required for a family farm. It is recognized that, with the progress of economic development and of farm technology, what constitutes a home maintenance area in one generation may very well be far too large for a family in the next. Accordingly, leasehold has been adopted as the general pattern of tenure. Land is leased from the Crown for periods of about 30 years (with rents assessed at more frequent—generally 10-year—intervals). On expiry of the lease it may be renewed for only part of the holding if closer settlement opportunities exist. The rest is subdivided and thrown open for ballot. Compensation is paid for structural improvements effected.<sup>5</sup>

In order to accelerate the opportunities for establishing more units based on intensive land use, the Lands Amendment Act of 1952 provided that, where a lease has more than seven years to run before expiry, the lessee may elect to surrender his lease immediately for closer settlement and, in consideration, will be permitted to retain two subdivisions or home maintenance areas. This legislation is increasing the rate at which land becomes available for closer settlement and is also helping to avoid the spasmodic development of holdings, which would otherwise result from a dead period, so far as investment in improvements is concerned, near the end of the lease.

Governments have not shown much willingness to increase the land tax sufficiently to force more intensive land use. However, a broad and effective set of measures to induce property development and to provide accommodation for family employees or share farmers has been introduced. This is in respect of taxation clauses. Exemptions can be claimed on a wide range of activities related to land development, establishment of

<sup>5</sup>This policy naturally is not without objections, some of which may be valid. Lessees claim that compensation is not adequate having due regard to the cost of achieving similar improvements at today's costs. Also it is claimed that the uncertainty of future tenure impedes development particularly towards the end of the lease.

watering facilities such as dam construction and soil conservation. Special depreciation allowances have been introduced in regard to purchases of developmental machines, the building of employee houses and the like. In the long-term leases of the semi-arid areas, developmental clauses that necessitate progressive establishment of water points and fencing are inserted.

It may be said that the urgent necessity for intensification of land use in Australia is being recognized and that some steps have already been taken to accelerate this development. However, it is extremely doubtful whether the present rate of intensification is sufficient, other things being equal, to provide the extra produce required to meet increased consumption and to finance the increasing import requirements of the expanding population. Whether or not there would be reasonably profitable export markets for the extra produce, if produced, is another issue, one that is dominated by the current surplus world stocks of many of those products on which Australian export income depends.

## LAND TENURE IN THE PHILIPPINES

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THE LAND tenure system of the Philippines is distinctive in its origins from that of neighboring Asian countries. Viewed in a broad problem setting, however, the issues are much the same. Most of the peasant population of the Far East have long been beset by three basic tenure problems: insecurity of occupancy, excessive rents, and usury.<sup>1</sup>

From these basic problems stems a chain of corollary features that lead, and have led, to revolution. Most important of these is the essential denial of participation, as a free constituent, in the economic, social, and political affairs of the society to which the individual is attached. A shorthand description, greatly oversimplified, is feudalism. Its hateful counterpart is colonialism. Between these extremes and that of a competitive brand of mass subjugation—Communism—the conflict with democratic methodology is joined in a massive contest of appeal to a restive agrarian people. In policy formulation, the most urgent objectives are maintenance of peace and order and the achievement of political stability. Nothing of a lasting character can be accomplished in the absence of either. The recent history of land tenure in the Philippines is cast in this framework.

In 1951, the Communist-led Hukbalahap movement in the Philippines came perilously close to gaining control of the government. Since then, a combination of "all-out friendship, all-out force" has prevailed, and the Philippine nation stands alone among Asian countries as one that repulsed a direct threat of Communist control without serious infringement of personal or property rights. The heart of this successful operation is the Magsaysay program of "land for the landless." As a prominent Manila newspaper recently stated editorially, "The crux of *all* the issues is land reform."<sup>2</sup>

Time will not permit a full development of the background of present land tenure problems in the Philippines, and I shall mention only a few central facts for reference. The existing pattern of tenure is the product of three eras of history. The first, or pre-Spanish period ending in the sixteenth century, is perhaps significant only for its *Barangay*, or tribal or-

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<sup>1</sup> These problems are discussed in more detail, by countries, in a paper by the author entitled "Comparative Notes on East Asian Land Tenure Systems," USOM International Cooperation Administration, Manila, July 1955.

<sup>2</sup> *Manila Daily Bulletin*, October 22, 1955.

ganization, which elevated the family relationship to a position of honor that survives to this day.<sup>3</sup>

The era of Spanish domination overlay more than three centuries and resulted in the introduction of several remarkably durable features that affect the present tenure of the land. Foremost of these was a well-defined private property right in the form of the *encomienda* system, a Spanish colonial version of the feudal economy of medieval Europe.<sup>4</sup> Under the Spaniards, large grants of land were dispensed to the favored few who, in turn, exacted tribute, or rent, from the peasant occupants. Among the later beneficiaries of Crown land were various church orders that eventually came to practice abuses so oppressive as to provoke open revolt among the tenants.

American rule comprised the third era. It brought a sense of order and equity that is today epitomized in frequent public references to "social justice." The United States introduced a concept of the public domain that is now making possible an orderly settlement of government lands, brought to bear the expropriation principle that is now a part of Philippine constitutional law, and initiated efforts to stabilize landlord-tenant relations. But the guiding policy was one of building toward ultimate native self-rule, and the United States consistently avoided a full-scale attack upon the ancient agrarian institutional structure.

For years the *taos* (peasants) voiced their protests against the harsh land tenure system. These protests often erupted into localized violence. It was not until World War II, however, that Filipino tenants acquired sufficient arms and the leadership to threaten overthrow of the government. The setting, up-dated to the beginning of effective reforms under the Magsaysay administration, may be summarized as follows:<sup>5</sup>

Three-fourths of the total population of 22 million persons are farm people.<sup>6</sup> About half the 2.3 million farms are operated by tenants, and more than two-thirds of the farms in all categories of tenure are less than 3 hectares in size. Nearly half the rice farms are operated by tenants. Tenancy rates on other farms on which the principal crops are coconuts, corn, abaca, tobacco and sugar cane range downward from 18 to one percent.

<sup>3</sup> Karl J. Pelzer, *Pioneer Settlement in the Asiatic Tropics*, American Geographical Society, New York, 1945, Chap. IV.

<sup>4</sup> *Ibid.*

<sup>5</sup> Data are based on figures from the 1948 Census of the Philippines, modified in some instances by revised estimates as of 1955. See "The ATC Report for 1955," the first annual report to the President made by the Agricultural Tenancy Commission, October 1955.

<sup>6</sup> Net annual increase in population in the Philippines is in excess of 2 percent. At this rate, the population will total approximately 55 million by the year 2,000.

There are both extreme fragmentation and extreme concentration of landholdings. A recent survey shows that only 221 landholdings exceed 1,000 hectares in size, but almost 14,000 holdings of 50 hectares or more total 2.4 million hectares, or about 42 percent of all the farmland in the country.<sup>7</sup> Some of the most acute problems of tenure are identified with these large holdings, especially in the rice lands of central Luzon.

Philippine tenants suffer from inefficient production methods and a low income status. Yields of rough rice average less than 30 cavans per hectare, or scarcely a third that of Japanese rice growers. It is estimated that the national average for family farm earnings does not exceed 800 pesos annually (\$400 at the legal exchange rate).<sup>8</sup> Manifestly more explosive than absolute levels of income and efficiency, however, are such matters as security of occupancy, rental rates, and interest charges on production and subsistence credit. Among the thousands of landlord-tenant disputes that arise each year, about a fourth involve ejection of the tenant and an almost equal proportion concern crop sharing.<sup>9</sup> Usury, with interest rates ranging from something like 50 to 400 percent, is a constant drain on the already inadequate income of tenants.<sup>10</sup> Money lending is a source of revenue to many landowners that almost equals the rental share. The significant function of this kind of credit, however, has been as a device for keeping tenants in debt and, as with the threat of ejection, perennially subject to the will of the dominant class of landowners.

The "land for the landless" program in the Philippines attacks these problems across a broad front. It is keyed to a basic goal of converting the maximum practicable number of farm tenants into owner cultivators, but it embraces certain auxiliary activities that are deemed essential to an

<sup>7</sup> Arturo P. Sorongon, "A Special Study of Landed Estates in the Philippines," USOM International Cooperation Administration publication, August 1955. These figures probably are conservative: See Part IV, "Appraisal of the Reliability of the Data," p. 11 ff.

<sup>8</sup> Based on data contained in "An Economic and Social Survey of Rural Households in Central Luzon," USOM Foreign Operations Administration and Philippine Council for United States Aid, by Generoso F. Rivera and Robert T. McMillan, June 1954.

<sup>9</sup> *Op. cit.*, "The ATC Report," Appendix H (a).

<sup>10</sup> "Average" interest rates charged tenants are hard to compute because of the variety of money-lending practices. Three common systems are known as *takipan*, under which the borrower repays 2 cavans (97 pounds each) of palay (rough rice) for each cavan borrowed, *talindia* (3 for 2), and *tercianah* (4 for 3). Actual interest rates are much higher than those suggested by these ratios, however, because most loans are made as the new harvest approaches and usually cover a period of only 3 to 6 months on each loan. Discounting on cash loans is widely practiced. Conversions are often made from money to rice at the time the loan is made, when the price of rice is high, and reconverted from rice to money after the harvest when the price customarily drops, thus increasing interest charges very substantially. Frequently, loans are made in the form of rough rice and repaid in higher priced polished rice. See Robert S. Hardie, "Philippine Land Tenure Reform—Analysis and Recommendations," STEM, Mutual Security Agency, Manila, 1952, Appendix C.

effective, integrated program of land reform. The objectives of the Philippine program are as follows:<sup>11</sup>

1. To reduce the area of large landholdings and at the same time, through the family farm principle,<sup>12</sup> to reduce the number of holdings of uneconomically small size.
2. To resettle tenants from heavily populated areas on vacant public lands in other areas.
3. To provide an adequate production credit system for small farmers.
4. To lower rental rates, provide security of tenure, and otherwise place landlord-tenant relations on a tolerable basis.
5. To achieve security of land titles.
6. To reform the property tax structure.

A brief review of the progress made toward each of these objectives will describe the present status of land reform in the Philippines.

#### *Land Redistribution*

The constitution of the Philippines provides that "Congress may authorize, upon payment of just compensation, the expropriation of lands to be subdivided into small lots and conveyed at cost to individuals."<sup>13</sup> Congressional authorization has been extended in a number of laws, some dealing with specific parcels of land and others conveying a general grant of power to the President to carry out expropriation proceedings.<sup>14</sup> The chief stumbling block in the way of a large-scale expropriation program has been lack of funds. "Just compensation" has been defined by the courts essentially as market value, usually a high figure in relation to productive value, and the requirement laid down that except in cases of voluntary sale the landowner must be reimbursed in cash at the time of the purchase.<sup>15</sup>

In an effort to overcome this obstacle, President Magsaysay last year submitted a new law known as the Land Reform Act of 1955, to the Con-

<sup>11</sup> See President Magsaysay's State of the Nation Messages, 1954 and 1955.

<sup>12</sup> "Family-size farm units—shall mean such area of farm land as will permit the efficient use of the labor resources of the farm family, taking into account the addition of such supplementary labor as may be necessary either for seasonal peak loads or during the developmental and transitional stages of the family itself." Land Reform Act of 1955.

<sup>13</sup> Art. XIII, Sec. 4.

<sup>14</sup> Until 1955, two of the most significant laws were Commonwealth Act 539 and Republic Act 1000.

<sup>15</sup> The extent of the expropriation power is treated in numerous cases; e.g., *Guido vs. Rural Progress Administration* and *Republic of the Philippines vs. Cirilo P. Baylosis et al.* Among the leading cases involving a definition of "just compensation" are *Manila Railroad Company vs. Velasquez*, 32 Phil. 286, and *Tarlac vs. Besa*, 55 Phil. 423.

gress that called for the use of "land certificates" in payment for expropriated lands. It passed in a special session after undergoing amendments that curtailed rather than enhanced the President's powers.<sup>16</sup>

Nevertheless, President Magsaysay has appointed officials of the Land Tenure Administration, which was established by the law, and has named 10 estates for early purchase. Meanwhile, he has begun a public campaign to have the law amended in the next session of Congress in order to make it more workable. This procedure follows a familiar pattern of step-by-step assault by Magsaysay upon his political opposition. It is safe to predict that the Philippines has a land redistribution program in the making. Some of its features are worth noting.

1. Unlike land-transfer schemes in many other countries, the purchase of large landholdings in the Philippines probably will not contain an element of confiscation. Constitutional law holds a lofty place in the Philippine system of values.

2. Reconstitution of farm unit size, in the interest of more efficient production, has received official recognition in the law and in the policy. Tenants who are displaced in the process will be relocated in government resettlement projects.

3. Ricelands in central Luzon are the priority target in the plan. They are not noted for outstanding yields or competent management. It is contemplated that economies of scale generally will be observed in the administration of the program.

4. A considerable volume of capital in land investment may be released in the process and forced into badly needed industrial development.

#### *Resettlement*

It is estimated that approximately 4 million hectares of arable public land remain open for settlement in the Philippines.<sup>17</sup> Before 1954 the movement of farmers to free public land lacked effective organization. With the creation of the National Resettlement and Rehabilitation Administration (known as NARRA), a systematic plan for moving settlers and furnishing them with transition support and facilities was undertaken.

Under NARRA administration, 20 resettlement projects with an aggregate area of 586,000 hectares are now in active operation. In fiscal year 1955, more than 8,000 families were moved to newly opened land where

<sup>16</sup> For example, in placing a minimum size of 300 hectares on private holdings that may be expropriated and 600 hectares on corporate-owned holdings, except in instances of "justified agrarian strife."

<sup>17</sup> "Country Review of the Philippines," a paper presented at the FAO Center on Land Problems in Asia and the Far East, by Eligio J. Tavanlar and Deogracias E. Lerma. December 1954.

they received title to tracts from 6 to 10 hectares in size (as compared with a national average of 2.2 hectares). Three-fourths of these families came from such heavily populated rural areas as central Luzon. The goal for the current year is 12,000 families, and the long-range goal is 153,000 families.<sup>18</sup>

This major population redeployment is being accomplished at an average cost of 1,200 pesos (\$600) per family. This includes transportation, salaries of settlement officials, housing, simple tools, and subsistence items while the new settler is clearing his land and making a first crop. This whole sum is an advance to the settler; it is to be repaid in 10 annual installments after the third year. The program is coordinated with road-building plans and health, education, and welfare services furnished by other agencies.

#### Credit

The principal credit agency is the Agricultural Cooperative Credit Finance Administration (ACCFA). A multipurpose organization, the ACCFA has as its primary task the servicing of the credit needs of small tenant farmers. Its success may be measured by the fact that the ACCFA program now embraces 319 local credit cooperatives with a membership—predominantly tenants—of 188,000 and loans for production and subsistence purposes exceeding 37 million pesos annually. Its repayment record is about 90 percent, and many local cooperatives boast of a 100 percent record.<sup>19</sup>

Concentrating its activities originally in the troublesome areas of central Luzon, the ACCFA is gradually extending its services throughout the country. Training of personnel is one of the main factors that inhibits expansion, but this is regarded only as a temporary deterrent. The range of services is likewise expanding. It now includes educational work in farming methods for members, distribution of fertilizer, cooperative use of portable irrigation pumps, and even low cost retail outlets for household goods.

The credit program is furnishing loan funds to tenants at a fraction of the rates charged by private moneylenders. Its main role in land reform, however, is that of eliminating landlord credit as a device for maintaining control over the economic life of tenants. In giving tenants an opportunity to participate in decision making, the ACCFA is having an incalculable effect on the building of a democratic citizenry.

<sup>18</sup> National Resettlement and Rehabilitation Administration, "Annual Report of NARRA, Fiscal Year 1954-1955" (to the President of the Philippines), August 1955, and later information.

<sup>19</sup> Agricultural Cooperative Credit Finance Administration, "ACCFA, 1954-55 Annual Report" (to the President of the Philippines), January, 1956.

*Landlord-Tenant Relations*

In August 1954, the Philippines enacted into law Republic Act 1199, which is generally regarded as the most comprehensive landlord-tenant regulatory measure in the world. Known as the "Magna Charta" for Philippine tenants, the law contains these major provisions:

1. It increases the tenant's share of the produce.
2. It covers all crops instead of rice alone as in previous legislation.
3. It grants tenants greater management prerogatives and the right to shift from a share arrangement to a leasehold tenancy (cash or standing rent).
4. It provides what amounts virtually to life tenure for all tenants, subject only to narrowly circumscribed landlord rights to evict for "just cause."
5. For the first time, it establishes criminal penalties for violations.
6. It limits interest charges to 8 percent.

The Agricultural Tenancy Commission (ATC) was created in October 1954 to implement the nonjudicial aspects of the law; that is, information, mediation, and research. In 9 months' operation with a small nucleus staff, the ATC distributed 150,000 information leaflets on the new law, 40,000 copies of the law itself, and 11,000 improved lease forms.<sup>20</sup> The agency conducted 214 information rallies in the provinces, which were attended by approximately 75,000 people and reached millions of other persons through press and radio releases. It rendered nearly 1,200 written and oral opinions on the construction of the law and resolved tenancy disputes, without court action, in cases that involved a total of 44,000 tenants. A start was made toward developing a research program to furnish guidance for future amendments and refinements of the law.

ATC officials estimate that full implementation of the tenancy law will result in the transfer of about 27 million pesos annually from landowners to tenants on ricelands alone.<sup>21</sup> In addition to raising the level of living of thousands of farm families, it is believed that this redistribution of income will strengthen the demand for domestically produced goods, while at the same time it lowers demand for some high cost import items, and that it will have a salutary effect on the growth of Philippine industry.

The work of the Commission has been expanded about fourfold this year. In its educational drive alone, the ATC plans to distribute 5½ million pieces of information literature prepared in English and the 6 principal dialects.

Another far-reaching step was taken in the tenancy field in the sum-

<sup>20</sup> *Op. cit.*, "ATC Report."

<sup>21</sup> *Op. cit.*, "ATC Report," Appendix J.

mer of 1955 when a Court of Agrarian Relations was created.<sup>22</sup> The previous court facility had been struggling with an annual docket of some 2,500 landlord-tenant cases. In some instances, settlements were delayed several years while hostility between the disputants continued to grow. The new agrarian court will be staffed by 8 associate judges assigned to the provinces and one executive judge sitting in Manila who will have exclusive jurisdiction in landlord-tenant cases and concurrent jurisdiction with the regular courts in farm employer-employee and usury cases.

This court is unique in that the judges will function on a mobile basis, being authorized to hear cases in the municipality or barrio (village) in which the subject matter landholding is located. Delays in rendering decisions will be discouraged by a provision calling for suspension of the salary of judges who fail to act on a case within prescribed time limits. Except for the right of direct appeal to the Supreme Court, decisions of the Court of Agrarian Relations will be final. Thus, the objective will be not merely to bring justice directly to the people, but to bring it swiftly.

### *Security of Land Titles*

A policy that favored owner cultivation would have little meaning if land surveys and titles were clouded. Following a history of "niggling technical doubts" about the validity of official land records, the present administration in the Philippines has placed strong emphasis on improving the system of cadastral surveys, the issuance of land patents, and registration of titles.

A complete modernization program in the Bureau of Lands was carried out in 1954 and 1955. As a result, the volume of land patents issued was increased from 3,400 patents covering 40,000 hectares in 1952 to 50,000 patents covering 450,000 hectares in 1955.<sup>23</sup> A Land Registration Commission was created in 1954. Using the Torrens system, it is keeping pace with the Bureau of Lands in registration of titles. The goal for this year is 60,000 registered titles.

### *Property Taxes*

Reformation of the property tax structure is the only one of the 6 objectives of the Philippine land reform program toward which little progress has been made. It poses a tremendous problem. Although land is by far the most important resource of the nation, it provides a relatively small part of all government revenues. The maximum nominal rate is set at one percent of the assessed value. Assessments for farm land aver-

<sup>22</sup> Republic Act 1267.

<sup>23</sup> Bureau of Lands, Department of Agriculture and Natural Resources, Republic of the Philippines, "Progress Report—Modernization and Mechanization," February 1955.

age only 51 percent of market value and vary widely from one province to another. Finally, only 54 percent of the taxes owed on farm property are actually collected. In 1951 the cumulative delinquency for farm land was 117 percent of the annual taxes due on this type of property.<sup>24</sup>

Plans are being drafted for revision of the entire property tax mechanism, and it is expected that tax legislation of some kind will be introduced in the 1956 session of Congress. To be adequate, such legislation probably will need to reinforce national control over property tax policies, strengthen foreclosure procedures, give provincial and municipal governmental units greater incentives in the form of a share of tax revenues, and raise the standards and salaries of local tax officials. Considerable interest is currently shown in the possibilities of a graduated land surtax as a further discouragement of concentration of landholdings.

### *Interrelationships*

Land reform policy in underdeveloped countries is sometimes defined in the narrow context of land redistribution. Elevation of tenants to the status of ownership by transferring a relatively few land titles to many tillers of the soil has certain advantages. For one thing, it is a comparatively simple technique for providing security of occupancy. For another, it is less costly than a more diversified program of adjustment. It requires a smaller outlay for mass educational work, training of technicians, and supplementary programming of various types.

However, this single-shot corrective has serious disadvantages. Usually, massive land-transfer operations involve at least partial confiscation which works an injustice on certain groups in society and generally lowers respect for private property rights. Such a program may fail to provide for the development of the managerial capacities of farmers who are accustomed to supervision. It tends to slight such vital complementary factors as credit, taxes, and title certification. Its ultimate effect may be to hamper rather than to facilitate the flow of resources to their most productive uses.

The great power of the land reform program in the Philippines lies in its versatility and flexibility. The combined effect of the 6 components of the program is a fundamental union of purpose. Each of the activities described above reacts upon and strengthens the others. Large holdings are to be bought and resold in smaller parcels, but purchase prices are high because of a small tax burden, high rents, and large returns from usurious lending practices. Therefore, land values are to be depressed by raising taxes and improving collections, by lowering rents, and by pro-

<sup>24</sup> Melville A. Monk and O. J. McDiarmid, "Taxation of Real Property in the Philippines," USOM Foreign Operations Administration, Manila, November 1953.

viding low cost credit through government sponsored cooperatives. Settlement of public land is to be accelerated in the very process of expropriating large holdings. At the same time, it will achieve a more economical average scale of operation in both areas. Tenants once were discouraged from joining a credit cooperative by threats of eviction; but protection against unwarranted eviction is now assured by the tenancy law. The ambition to become a farmer owner through resettlement or purchase of a part of an expropriated estate is stimulated by a system of valid land titles, by the availability of production credit at reasonable rates, and by the prospect of an equitable tax program.

In his struggle to emerge from a feudalistic tradition and centuries of colonial rule, the Philippine tenant is now offered genuine economic alternatives for the first time. The land reform program fashioned for him is the most complete and best integrated in the world today. Despite the striking accomplishments already recorded, much of it is still on the drawing boards. To convert these plans into action will call for all the energies, talents, and integrity that can be brought to bear in this young republic.

## ESTIMATION OF ECONOMIC RELATIONSHIPS\*

Chairman: Harry Markowitz, The Rand Corporation

### THE DYNAMICS OF THE ONION MARKET

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#### *Introduction*

THE BEHAVIOR of onion prices and production clearly reflects the operation of powerful dynamic forces. In fact, the systematic annual oscillations of prices and outputs shows the onion market to be almost a textbook example of an agricultural cobweb system. It is the purpose of this paper to capture this system in a three equation econometric model and to analyze its dynamic properties.

The econometric model will be derived from the aggregate behavior of the market, i.e. for the United States as a whole on a crop year basis. This abstraction from the regional nature of onion production, the seasonal timing of crops and the attendant problems of speculation and storage, provides us with only a first approximation to the nature of the underlying market structure. The analysis of the regional structure of the market will be carried forward at a later date. As an example of the kind of analysis required, however, we shall include here some interesting relationships between the early spring crop (South Texas) and the stock of onions in storage on January first, although as will be indicated, the validity of these preliminary results is open to question.

#### *The Model*

The model of the aggregate onion market consists of three relationships: (1) a supply schedule relating the quantity of onions available for harvest to prices and costs of the preceding year, (2) a demand equation relating the per capita consumption of onions to farm price and per capita disposable income, and (3) an unharvested crop equation in which the quantity of onions unharvested is related to current price and harvesting cost.

#### *Supply*

The fitted supply schedule for onions is the following:

$$(1) \quad \text{Log } Q_t = .324 \text{ Log } P_{t-1}^f - .512 \text{ Log } C_{t-1} + .0123t + .134$$

Where  $Q$  is number of 50 pound sacks available for harvest,  $P^f$  is the

\* Joint session of the American Farm Economic Association and the Econometric Society.

farm price of onions, C is the prices paid index and t is time in years, measured from 1924 = 0. For ease in computation the price is measured in units of 10 cents, quantity in units of 10 million sacks, and the prices paid index in units of ten points. Such coding, of course, leaves the regression parameters unaffected, but influences the magnitude of the constant term.

The regression parameters of the supply equation were fitted by least squares to first differences. The constant term was then obtained by fitting the equation to the means of the actual (i.e. undifferenced) values over the period. The method of first differences was used for two reasons. First it serves to avoid any major bias in the estimates that might otherwise arise due to autocorrelation of residuals. Secondly, the prices paid index is a very crude measure of production costs. To the extent that production costs tend to be sticky, the first differences in price alone will tend to produce a useful estimate of price elasticity, whereas any attempt to estimate the price elasticity of supply directly from undifferenced prices alone will necessarily lead to spurious results.<sup>1</sup>

The fitted difference equation was:

$$(1^*) \quad \Delta \text{ Log } Q_t = .324 \Delta \text{ Log } P_{t-1}^f - .512 \Delta \text{ Log } C_{t-1} + .0123$$

(.06)                    (.3)

where figures in parentheses are standard errors. The coefficient of multiple correlation was  $\bar{R} = .73$ . The supply schedule indicates a price elasticity of about .3 and a cost elasticity of about -.5. The coefficient of the time variable indicates a trend over the period of roughly 3 percent per year. It will be noted that the price elasticity is measured with considerable precision, while the cost elasticity is less certain. This uncertainty arises from the sticky nature of the prices paid index as noted above.

The comparison of the actual onion crop with that calculated from equation (1) is given in Figure 1. It will be noted that the performance leaves much to be desired, particularly in the early period.

### *Demand*

Like supply, the estimated demand schedule is in logarithmic form and was obtained by a least squares regression in first differences and then fitted to the averages of the period. The result obtained was:

$$(2) \quad \text{Log } P_t^f = - 2.27 \text{ Log } (D/N)_t + 1.31 \text{ Log } (Y/N)_t + .681$$

where D/N is crop year demand per capita and Y/N is per capita disposable income. Crop year demand was measured as crop less un-

<sup>1</sup> We may note in this connection that the elasticity of supply as estimated from first differences in price only is .30, differing only slightly from that given in equation (1).

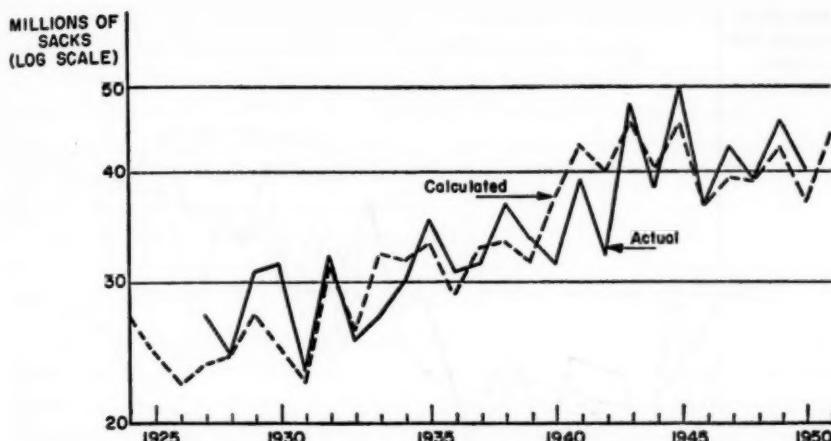


FIG. 1. ONION PRODUCTION, ACTUAL AND CALCULATED FROM EQUATION (1), 1924-1951.

harvested crop less net exports. Disposable income was measured annually on a calendar year basis, and hence actually leads the crop year by roughly one quarter.

The first differences were fitted in a homogeneous form, no allowance being made for a trend in demand. The homogeneous regression in first differences was:

$$(2^*) \quad \Delta \text{Log } P_t^f = -2.27\Delta \text{Log } (D/N)_t + 1.31\Delta \text{Log } (Y/N)_t \quad (4) \quad (2)$$

This regression was fitted to the period 1929-1952; the coefficient of multiple correlation was  $R = .9$ .

Equation (2\*) compares favorably with that obtained by Shuffett<sup>2</sup> who related farm price to per capita crop and disposable income, his result being, in our symbols,

$$\Delta \text{Log } P_t^f = -2.227\Delta \text{Log } (Q/N)_t + 1.111\Delta \text{Log } (Y/N)_t + .007. \quad (2) \quad (3)$$

When equation (2) is transformed into the usual demand form, it becomes:

$$(2.1) \quad \text{Log } (D/N) = -.44 \text{ Log } P^f + .58 \text{ Log } (Y/N) + .300.$$

It is evident that the price elasticity of demand is about  $-.4$  and the income elasticity is approximately  $.6$ . The comparison of actual and calculated price is shown in Figure 2.

<sup>2</sup> D. Milton Shuffett, *The Demand and Price Structure for Selected Vegetables*, U. S. Department of Agriculture, Technical Bulletin No. 1105, December 1954, p. 116.

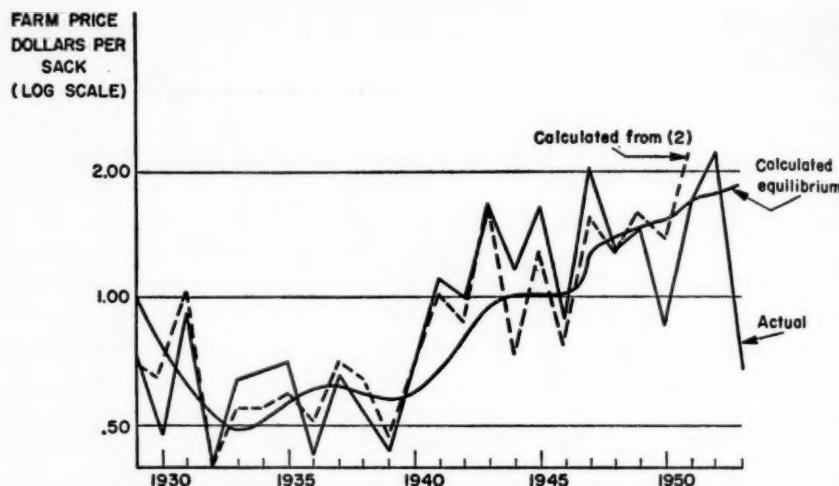


FIG. 2. FARM PRICE; ACTUAL, CALCULATED FROM EQUATION (2), AND CALCULATED EQUILIBRIUM.

### *Unharvested crop*

The final equation in the aggregate model relates the unharvested crop ( $U$ ) to current price ( $P^a$ ), harvesting cost ( $W$ ), the composite farm wage rate, and the quantity available for harvest ( $Q$ ). The relatively small number of years for which unharvested amounts were reported precluded the use of first differences in the investigation of this relationship, and the equation was fitted to undifferenced values of the (logarithmic) variables.

The price variable used to explain the unharvested crop was the average New York wholesale price for the third quarter of the calendar year. This decision was made on the ground that the average price of onions for the *crop* year necessarily includes prices received for crop sold

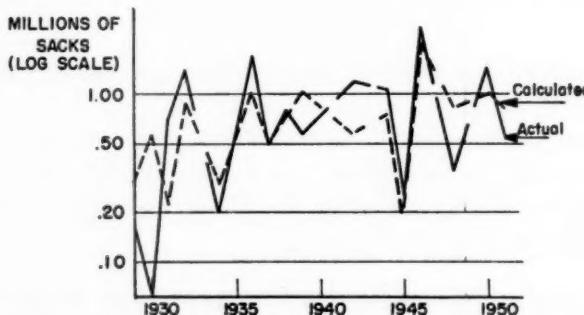


FIG. 3. UNHARVESTED CROP, ACTUAL AND CALCULATED.

long after the decision to harvest must be made. Such prices clearly cannot enter into the determination of the unharvested crop.

Since price and unharvested quantity are mutually determining variables in the onion market, the method of instrumental variables was employed to estimate the relationship. For this purpose, per capita onion production, per capita disposable income, and the industrial wage rate were taken as instrumental variables.

The resulting relationship obtained was:

$$(3) \quad \text{Log } U_t = -1.71 \text{ Log } P_t^t + .22 \text{ Log } W_t^t + 2.56 \text{ Log } Q_t + 1.84$$

Since the method of instrumental variable was employed, no standard errors are available. However, as the comparison of actual and calculated unharvested crop of Figure 3 shows, the result is of reasonable reliability. Taken at its face value, equation (3) indicates that a one percent decline in the average market price of the third quarter is accompanied by a 1.7 percent decrease in the unharvested crop, while one percent increases in farm wage rate and crop available for harvest tend to increase the unharvested quantity by .2 percent and 2.6 percent, respectively.

Equation (3) relates price to the unharvested portion of the onion crop, given the total crop. It may therefore be used to derive the elasticity of market supply given the crop of onions available for market. This elasticity may be derived as follows:

If  $X$  is the quantity of onions supplied to the market, then by definition the price elasticity of supply is

$$(3.1) \quad E = \frac{P}{X} \cdot \frac{dX}{dP} \cdot \text{Moreover, } Q, X \text{ and } U \text{ are related by}$$

$$(3.2) \quad X = Q - U. \quad \text{Whence, given } Q,$$

$$(3.3) \quad \frac{dX}{dP} = -\frac{dU}{dP}$$

Now from (3), given  $Q$  and  $W^t$ ,

$$(3.4) \quad \frac{1}{U} \frac{dU}{dP} = -1.71(1/P)$$

substituting (3.3) and (3.4) in (3.1) then yields

$$(3.5) \quad E = 1.71U/X$$

It will be noted that the market supply elasticity, given crop, approaches zero as price approaches the level at which the entire crop is harvested ( $U = 0$ ). The elasticity of market supply tends to rise as price falls below this level. At any realistic value for  $U/X$ , however, the elasticity of market supply is well below the elasticity of crop supply. In fact equality between the two elasticities would be reached at a value for  $U/X$  of about 20 percent i.e. at a price at which about 16 percent of the

total crop would be left unharvested. This may be compared with a maximum observed unharvested crop of about 5 percent of total available.

Because the unharvested crop is an unimportant portion of the market, this relationship was suppressed in the analysis of the market dynamics.

### *Dynamics of the Market*

We may now combine the demand and supply equations together to obtain a difference equation (5) expressing the dynamic behavior of onion prices. This equation can then be analysed to determine: (5.2) the equilibrium value that price would approach, other factors remaining stationary, (5.5) the course that price would tend to follow in approaching this equilibrium, and the speed with which it would tend to approach it, (5.7) the trend of this equilibrium price if other factors tend to follow prescribed trends, and finally (5.8) the complete dynamic expression for the tendency of price behavior given the trends in other factors.

Combining the demand and supply equations together requires a slight adjustment. It will be noted that the supply equation is in terms of total crop, while the demand is in terms of per capita disappearance. To enable us to make the required substitution, therefore, we calculated the average relationship between these two measures over the period 1929-1952:

$$(4) \quad \text{Log } (D/N) = \text{Log } Q - \text{Log } N - .0178$$

Inserting (1) and (4) in (2) yields the following difference equation in farm price  $P^t$ :

$$(5) \quad \text{Log } P_t^t = -1735 \text{ Log } P_{t-1}^t + 1.162 \text{ Log } C_{t-1} - .028t + 2.27 \text{ Log } N_t \\ + 1.31 \text{ Log } (Y/N)_t + .416$$

The symbols have the meanings previously assigned. It will be recalled that  $t = 0$  in 1924.

Equation (5) may be looked upon as the price forecasting equation based on the fitted supply and demand schedules. The performance of this forecasting equation is shown in Figure 4. It must be borne in mind that at no point in the analysis have we made any allowance for the influence of the war on the behavior of the model. In view of this fact the forecasting equation may be judged to have performed reasonably well for the period after 1935, since, although it badly underestimates the level of prices during the war period, its estimate of year-to-year changes is good.

To determine the equilibrium value of  $P^t$  under the conditions prevailing at time  $t$ , we may set  $P_t^t = P_{t-1}^t = P_e^t(t)$  and solve to obtain

$$(5.2) \quad \text{Log } P_e^t(t) = .67 \text{ Log } C_{t-1} - .016t + 1.31 \text{ Log } N_t + .76 \log (Y/N)_t + .24$$

where  $P_e^t(t)$  is the value of farm price that would be approached if the conditions prevailing in year  $t$  were to continue indefinitely. Among the conditions of year  $t$  is specifically included the time indicator  $t$  itself. It may appear at first sight, therefore, that we are simultaneously assuming that time is to continue indefinitely and is also to stand still. Such is not the case. The supply of onions is influenced by a host of technical factors whose improvement over the period must be taken into account.

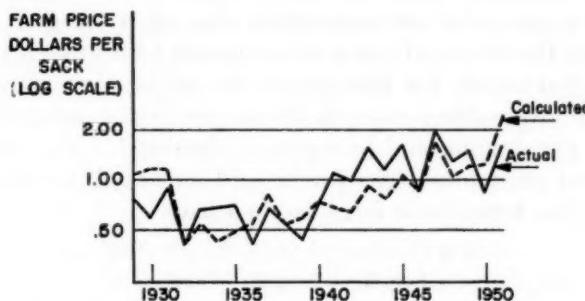


FIG. 4. FARM PRICE, ACTUAL AND CALCULATED FROM EQUATION (5).

In using  $t$  for this purpose, it becomes a *dummy* variable representing the stage of technology. Thus in holding  $t$  constant in equation (5.2) we are supposing the level of technology to remain unchanged. We do this with precisely the same justification with which we may suppose population or per capita disposable income to remain unchanged.

The equilibrium values associated with each time  $t$  are plotted together with actual farm prices in Figure 2. With the exception of the war period we observe that current prices tend to fluctuate around the relatively smooth equilibrium series.

Equation (5) enables us to analyze the fluctuations of current price around its equilibrium value. Holding all other things constant (5) becomes

$$(5.3) \quad \text{Log } P_t^e = - .735 \text{ Log } P_{t-1}^e + H$$

where  $H$  is the value of the remaining variables on the right of (5).

Since the equilibrium values of (5.2) also satisfy (5.3) we may subtract to obtain

$$(5.4) \quad P_t^* = - .735 P_{t-1}^*$$

where  $P_t^*$  is the deviation of current (log) farm price from equilibrium at time  $t$ . The solution of this difference equation is clearly

$$(5.5) \quad P_t^* = P_0^* (-.735)^t$$

where  $P_t^*$  is the deviation from equilibrium  $t$  years after the deviation  $P_0^*$ .

We may conclude that current farm price tends to perform a damped oscillation around its equilibrium value. The period of this oscillation is clearly two years, a price above equilibrium tending to be followed by one below. Each full cycle tends to bring the (log) price half way toward its equilibrium position, and 90 percent of the deviation from equilibrium is recovered in about 7 years.<sup>3</sup>

Finally we may relax our assumption that other things remain equal and ask what the course of onion prices would tend to be if other things follow specified trends. For this purpose let us assume a secular increase in per capita disposable income of 3.0 percent per annum, in population 1.8 percent per annum, and in supply technology at the observed rate of 3.0 percent per annum. The prices paid index will be taken as fixed. Translating into logarithmic form we then have

$$\begin{aligned}\text{Log } (Y/N)_t &= \text{Log } (Y/N)_0 + .013t \\ \text{Log } N_t &= \text{Log } N_0 + .008t \\ C_t &= C_0\end{aligned}$$

where the indicator  $t$  represents number of years after the initial position  $t = t_0$ .

Substituting these values in (5) yields an equation of the form

$$(5.6) \quad \text{Log } P_t^t + .735 \text{Log } P_{t-1}^t = H_0 + .007t$$

where the right side represents the combined trend influence of the other variables  $t$  years after an initial position at  $t = 0$ . The moving equilibrium of (5.6) is readily determined to be

$$(5.7) \quad \text{Log } \widehat{P}_t = \frac{H_0 + .735}{1.735} + .004t$$

This represents an upward trend in price of slightly less than one percent per year. In view of the nature of the statistical equations from which this result is derived, it is hard to credit it with significance; but we are surely safe in concluding that the general trend in onion prices under the reasonable assumptions made is of a very low order of absolute magnitude and clearly negligible in any short period.

The combination of (5.7) and (5.4) gives us the complete dynamic equation of onion prices;

$$(5.8) \quad \text{Log } P_t^t = \frac{H_0 + .735}{1.735} + .004t + P_0^*(-.735)^t$$

<sup>3</sup> To obtain this result we set.

$$\begin{aligned}(.735)^t &= .10 \quad \text{so} \\ t \log .735 &= \log .1 \quad \text{or} \\ -.134 t &= -1.0 \quad \text{and} \quad t = 7.46\end{aligned}$$

where  $P_0^*$  is the deviation of (log) price from moving equilibrium at some initial time  $t = 0$ . (5.8), of course, represents the oscillation of (5.5) around the slightly rising trend in prices of (5.7).

*"Fine structure" Dynamics: An Example*

The foregoing analysis has been entirely based on the behavior of the entire market, averaged over a complete crop year. But the fact that onions are grown in different regions, the crops maturing at different times, means that there is a fine structure to the dynamics of the market, defined by the relationships among these regions and harvest periods. It is our hope that we can ultimately capture the nature of this fine structure in a more detailed model of the market. At present we are able to present only a particular example of the "fine" structure of the dynamics.

The problem to be analyzed is the relationship between the stock of onions on January 1 and the early spring crop in south Texas which ordinarily becomes available for market late in the first quarter or early in the second quarter of the year. In as much as the stock of onions on hand represents potential competition for early onions, and since growers are informed about the magnitude of this stock at the time planting is done, we should expect the early supply of onions to be influenced by the stock on hand.

To determine this influence, a supply schedule was fitted to the south Texas region, relating the early onion crop, ( $Q_t^*$ ) to last year's farm price in the region ( $P_{t-1}^*$ ), to last year's farm price of Texas carrots ( $C_{t-1}^*$ ) and the per capita stock, January 1, ( $S/N)_t$ . The price of carrots was used as an opportunity cost to marginal onion producers.

In fitting the regression the extreme values for the year 1941 were deleted from the data, the period 1929-1953 being used. The resulting supply equation for south Texas was

$$(6) \quad \text{Log } Q_t^* = .437 \text{ Log } P_{t-1}^* - .353 \text{ Log } C_{t-1}^* - .520 \text{ Log } (S/N)_t + .070$$

(.099)	(.112)	(.149)
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The elasticities of price and cost in this supply equation compare favorably with those obtained for the nation as a whole. Moreover we see that the influence of the stock of onions on south Texas production is highly significant, and indicates that an increase of one percent in the per capita stock of January 1 tends to reduce the south Texas onion crop by one half of one percent.

The equation was fitted to undifferenced values but a test of the residuals fails to show significant auto correlation.

We may now ask whether there is a reverse influence between the early crop of onions and the sale of the stock. The argument runs as follows. Although the stock of onions on January 1 is historically given, the time dis-

tributions of its sale is subject to the decision of the holder. If a large early crop is anticipated, the stock will tend to be sold early to avoid the falling price which the competition of the spring onions would cause. On the other hand the expectation of a small crop should tend to postpone the sale of stock to take advantage of the improved market. Thus there should be a significant relationship between the shipment of stock during the first quarter (before the early crop is marketed) and the size of the early crop. For the years 1936 to 1948 the percent of stock shipped by months, January through May, have been estimated.<sup>4</sup> By simple addition one can calculate the percent of shipment that occur in the first quarter. The relationship between this percentage (I), the stock on hand (S) and the early spring crop ( $Q^*$ ) was determined to be

$$(7) \quad \begin{aligned} \text{Log } I &= .106 \text{ Log } Q^* - .021 \text{ Log } S + .915 \\ &\quad (.03) \qquad \qquad (.05) \end{aligned}$$

This relation says that the percentage of stock that will be supplied to the market during the first quarter of the year is significantly related to the size of the approaching harvest (which will come on the market during the second quarter) and not significantly related to the actual size of the stock.

It is tempting at this point to combine equations (6) and (7) together with a supply schedule for late summer onions (from which the stock is derived) and the demand, to work out the dynamic structure of this part of the market. That we have not done so is due to the serious doubts we have regarding the validity of equation (7).

Equation (7) is clearly compatible with the hypothesis we had in mind in deriving it. Our doubts concern the data employed in fitting it. Although the figures used purported to be estimates of the percentage of stock shipped, we are inclined to believe they were obtained from a percentage distribution of shipments. In that case the percentage of shipments occurring in the first quarter is directly determined by the amount shipped thereafter and equation (7) is compatible with another, and in our opinion more likely hypothesis: that onions are shipped from storage until storage onions can no longer sell in competition with the new harvest, at which time they are dumped.

Given the data, equation (7) cannot distinguish between the two hypotheses. Nor, since both are doubtless valid to some extent, can it separate one effect from the other.

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<sup>4</sup> *Production and Marketing of Commercial Onions*, Production & Marketing Admin., Fruit & Vegetables Div., January 27, 1949, Mimeo., Table 9.

# EFFECTS OF SHOCKS AND ERRORS IN ESTIMATION: AN EMPIRICAL COMPARISON\*

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IN ORDER for limited information single equation (L.I.S.E.) estimates to be maximum likelihood estimates, certain conditions must be met. These conditions are listed in various places and will not be studied here.<sup>1</sup> The one condition pertinent to this paper is that errors of observation be negligible. This study uses experimental methods to obtain distributions of L.I.S.E. estimates when this assumption is violated but all others are met; it also compares these with distributions of the least squares (L.S.) coefficients.

## I. Model and Data

The model selected for this study was this complete, overidentified, non-dynamic model;

$$(1) \quad Y_1(t) = b_{12}Y_2(t) + C_{11}Z_1(t) + C_{12}Z_2(t) + C_{13} + U_1(t),$$
$$(2) \quad Y_2(t) = b_{23}Y_1(t) + C_{22}Z_3(t) + C_{24}Z_4(t) + C_{25} + U_2(t),$$

in which the  $Y_i(t)$  are endogenous, the  $Z_i(t)$  are exogenous and the  $U_i(t)$  are random shocks. The structural parameters were assigned numerical values. The exogenous variables and the shocks were specified to be normally distributed and the population values of their means, variances and covariances were selected. The means, variances and covariances of the endogenous variables were computed from these through the reduced form equations.

A sample was constructed, consisting of 30 observations ( $t = 1, \dots, 30$ ) on each exogenous variable and each shock, using Wold's table of *Random Normal Deviates*.<sup>2</sup> The 30 sample values of  $Y_1(t)$  and  $Y_2(t)$  were then computed from the reduced form equations. This completed the construction of the sample of observations measured without error, referred to as sample zero from now on.

\* This paper is a condensation of a thesis submitted in partial fulfillment of the requirements for the Ph.D. at the University of Illinois. The author would like to express his appreciation for the assistance he received from the members of his thesis committee: Professors W. A. Neiswanger and D. P. Flanders of the College of Commerce and V. I. West of the College of Agriculture.

\*\* At Iowa State College when paper was delivered.

<sup>1</sup> T. W. Anderson and H. Rubin, "Estimation of the Parameters of a Single Equation in a Complete System of Stochastic Equations," *Annals of Mathematical Statistics*, Vol. 20, 1949, pp. 46-63. J. Marschak, "Statistical Inference in Economics: An Introduction," *Statistical Inference in Dynamic Economic Models*, ed. T. C. Koopmans (John Wiley and Sons, New York), 1950, pp. 20, 23, 33-34.

<sup>2</sup> No. 25 of *Tracts for Computers*, Edited by E. S. Pearson (Department of Statistics, University College, London), 1948, 51 pp.

The variable  $x_i^j(t)$  was defined as

$$(3) \quad x_i^j(t) = X_i(t) + e_i^j(t); \quad t = 1, \dots, 30; \quad i = 1, \dots, 6; \quad j = 1, \dots, 30;$$

in which  $X_i(t)$  is the sample zero true value of the  $i$ -th variable at time  $t$ ,  $x_i^j(t)$  is the observed value of the  $i$ -th variable at time  $t$  in the  $j$ -th sample, and  $e_i^j(t)$  is the error of measurement in the observed value  $x_i^j(t)$ . The synthetic errors of observation are normally distributed with mean zero, and are distributed serially independently and independently of each other, of the true variables and of the shocks. The relative error variances are in Table I.

TABLE I. RATIO OF VARIANCE OF MEASUREMENT ERROR TO  
TOTAL VARIANCE OF OBSERVED VARIABLE

Variable	Relative error variance
$y_1$	.125
$y_2$	.080
$z_1$	.265
$z_2$	.089
$z_3$	.189
$z_4$	.100

Thirty samples were constructed from Wold's table, each sample consisting of 30 observations ( $t = 1, \dots, 30$ ) on each of the 6 errors of measurement. These errors were added to the sample observations on the true variables as in (3) above.

## II. Computations

The computations were carried out for each of the 31 finite samples and for 2 infinite samples, one containing errors of observation and the other not. Virtually all of the calculations were performed on the Illiac, the University of Illinois' high speed digital computer. The results are tabulated in Tables II and III.

## III. Conclusions

The method used to construct the data indicates that the proper comparison to make in order to study the effects of errors of observation is a comparison between the coefficient computed from sample 0 and the mean of the coefficients computed from samples 1 through 30. Each of the latter contains the same random errors of sampling that zero contains, plus its own distinctive random errors of sampling of the observational errors. In the following discussion, mean estimate or standard deviation refers to the mean or standard deviation of the coefficients from samples 1 through 30.

TABLE II. ESTIMATES OF THE COEFFICIENTS AND THEIR STANDARD ERRORS

Coefficient	Sample	L.S. estimate	L.S. standard- ized estimate	Standard error of standard- ized estimate	L.I.S.E. estimate	L.I.S.E. standard error
$b_{12}$ $(=0.20)$	0	0.2273	0.6911 <sup>a</sup>	0.0825	0.2085 <sup>a</sup>	0.04054
	1-30					
	Mean	.1771	.5185 <sup>b</sup>		.2275 <sup>c</sup>	
$C_{11}$ $(=-0.08)$	0	.04793	.10049	.0698	.04858	.03965
	1-30					
	Mean	.05901	.12863 <sup>d</sup>		.06054 <sup>e</sup>	
$C_{12}$ $(=-0.45)$	0	.5250	1.1836 <sup>a</sup>	.0884	.5083 <sup>a</sup>	.08683
	1-30					
	Mean	.4364	.9667 <sup>f</sup>		.4757 <sup>g</sup>	
$b_{22}$ $(=0.30)$	0	-.05168	-.15709	.1586	-.2459 <sup>a</sup>	.08247
	1-30					
	Mean	-.04709	-.14021 <sup>b</sup>		-.2709 <sup>i</sup>	
$C_{22}$ $(=-0.15)$	0	.1596	.4551 <sup>a</sup>	.1583	.09452	.07032
	1-30					
	Mean	.1391	.4094 <sup>j</sup>		.08058 <sup>k</sup>	
$C_{24}$ $(=-0.28)$	0	.1832	.3839 <sup>l</sup>	0.1661	.3088 <sup>a</sup>	0.1029
	1-30					
	Mean	.1603	.3468 <sup>m</sup>		.2766 <sup>a</sup>	
	Std. dev.	0.0519	0.1069		0.0678	

<sup>a</sup> Significantly different from zero at 1 percent level.<sup>b</sup> 26 estimates significantly different from zero at 1 percent level; 2 more significant at 5 percent level; 1 significantly different from zero and from parameter at 5 percent level.<sup>c</sup> 10 estimates significantly different from zero at 1 percent level; 14 more significant at 5 percent level.<sup>d</sup> 5 estimates significantly different from zero at 1 percent level.<sup>e</sup> 5 estimates significantly different from zero at 1 percent level (same ones as in d) and 1 significantly different from parameter at 5 percent level.<sup>f</sup> All significantly different from zero at 1 percent level; 1 significantly different from parameter at 5 percent level.<sup>g</sup> All but two significant at 1 percent level and these two are significant at 5 percent level.<sup>h</sup> 1 significantly different from zero at 5 percent level; all but 1 significantly different from parameter at 1 percent level, this one significantly different at 5 percent level.<sup>i</sup> 8 estimates significant at 1 percent level; 21 significant at 5 percent level.<sup>j</sup> 10 significant at 1 percent level; 14 significant at 5 percent level.<sup>k</sup> 3 significant at 5 percent level.<sup>l</sup> Significant at 5 percent level; significantly different from parameter at 1 percent level.<sup>m</sup> 1 estimate significant at 1 percent level; 2 significant at 1 percent level and significantly different from parameter at 5 percent level; 9 significant at 5 percent level and significantly different from parameter at 5 percent level; 2 significant at 5 per cent level and significantly different from parameter at 1 percent level; 15 significantly different from parameter at 1 percent level and 1 at 5 percent level.<sup>n</sup> 9 significant at 1 percent level; 16 significant at 5 percent level.

TABLE III. L.I.S.E. ESTIMATES FROM INFINITE SAMPLES

Coefficient	Specified parameter value	Estimate from sample with no errors	Estimate from sample containing measurement errors
$b_{12}$	.20	.02004	.02124
$C_{11}$	.08	.0799	.0663
$C_{12}$	.45	.4502	.4193
$b_{22}$	-.30	-.3006	-.3272
$C_{23}$	.15	.1499	.1309
$C_{24}$	0.28	0.2804	0.2740

*Comparison of estimates from sample zero with mean estimates.* This study was designed to throw some light on the question whether the presence of errors of observation biases L.I.S.E. estimates or simply affects their random errors of sampling. The results from the finite samples suggest the latter. In 2 cases ( $b_{12}, C_{23}$ ) the mean is farther from the structural parameter than is the sample zero estimate, whereas in 4 cases it is closer. Oddly enough, in these 4 cases the presence of errors of measurement improves the estimates on the average. But only 45 of the 120 individual estimates of these 4 coefficients are closer to the parameter than the corresponding sample zero estimates are. And 13 of the 60 estimates of the preceding 2 coefficients are closer. In every case the difference between the sample zero estimate and the mean estimate is appreciably smaller than one standard error (whether computed from sample zero or the mean standard error of the other samples).

Turning to the L.S. estimates, we find that the mean estimates of the parameters in equation (1) are consistently closer to the true value than are the estimates from sample zero. Forty of the 90 individual estimates are closer to their respective parameters than are the corresponding sample zero estimates. On the other hand, the sample zero estimates of coefficients in the second equation are consistently closer. Of the 90 individual coefficients, 28 are closer than the corresponding sample zero estimates.

Tables IV and V contain some pertinent data that require no comment.

*Test of the normality of the distributions of the coefficients.* The chi-square test was applied to the estimates of each coefficient to test the hypothesis that they come from normal distributions. The class limits

TABLE IV. NUMBER OF ESTIMATES DIFFERENT FROM SAMPLE ZERO ESTIMATES BY MORE THAN SPECIFIED NUMBER OF SAMPLE ZERO STANDARD ERRORS

	Number of Estimates		
	$1\sigma$	$2\sigma$	$3\sigma$
L.S.	69	87	20
L.I.S.E.	55	21	8

were set so that the theoretical number within each class was as near to three as possible, i.e., so that each class would be expected to contain 10 percent of the observations. This theoretical frequency is smaller than the generally quoted minimum expected number of 5 or 10. However, Cochran cites 3 separate studies that indicate that the tabular values are

TABLE V. SAMPLE ZERO ESTIMATE CLOSER TO PARAMETER AND NUMBER OF REMAINING SAMPLES IN WHICH L.I.S.E. ESTIMATE IS CLOSER

Parameter	Closer sample zero estimate	Number of samples in which L.I.S.E. estimate is closer
$b_{11}$	L.I.S.E.	5
$C_{11}$	L.I.S.E.	15
$C_{12}$	L.I.S.E.	13
$b_{21}$	L.I.S.E.	29
$C_{21}$	L.S.	3
$C_{24}$	L.I.S.E.	27
Total		92

reasonably accurate if all expectations are at least 2.<sup>3</sup> Table VI tabulates the results of the test, which suggest that the L.I.S.E. estimates approach normality quite rapidly.

*Sign test.* Let  $X_{11}$  and  $X_{12}$  represent L.S. and L.I.S.E. estimates, respectively, from the  $i$ -th sample. The signtest tests the hypothesis that  $X_{11}$  and  $X_{12}$  are random drawings from populations possessing the same median value, and is based on the sign of the differences. Denoting by  $r$

TABLE VI. VALUES OF CHI-SQUARE

Coefficient	L.S. estimates	L.I.S.E. estimates
$b_{11}$	7.363	9.229
$C_{11}$	14.665*	6.607
$C_{12}$	12.882	4.071
$b_{21}$	5.387	8.022
$C_{21}$	8.888	5.313
$C_{24}$	12.277	10.983

\* Significant at the 5 percent level.

the number of times the less frequent sign occurs in the differences, we find a value of  $r$  significant at the one percent level for each coefficient in the second equation and no significant values in the first equation.

*t test.* The *t* test was applied to these differences to test the hypothesis that the two methods of estimation give the same mean values. Table VII lists the values of *t*. The test used does not require equality of the two variances to test a hypothesis of no differences in means. The *t* test cor-

<sup>3</sup> "The  $\chi^2$  Test of Goodness of Fit," *Annals of Mathematical Statistics*, Vol. 23, 1952, p. 329.

TABLE VII. VALUES OF  $t$  FOR PAIRED OBSERVATIONS

Coefficient	$t$
$b_{12}$	2.857**
$C_{11}$	0.488
$C_{12}$	2.793**
$b_{22}$	-20.727**
$C_{22}$	-9.209**
$C_{24}$	8.849**

\*\* Significant at the 1 percent level.

roborates the sign test in rejecting the null hypothesis on the parameters in the second equation but differs from the sign test in rejecting the null hypothesis on two coefficients in the first equation.

The difference between the results of the two tests may arise because of the greater efficiency of the  $t$  test when the observations come from normal populations.<sup>4</sup> It is almost certain that the distributions of L.I.S.E. coefficients from samples of 30 observations deviate from normal to some extent. However, Snedecor points out that even considerable departures from normality have slight effects on the accuracy of the tabular probabilities.<sup>5</sup> Granted this, then it is possible that, even though the distributions of the L.I.S.E. estimates differ from normal, the difference is in each case sufficiently small that the  $t$  test retains much of its efficiency over the sign test. Then it might be expected that the  $t$  test would reject the null hypothesis in situations in which the sign test did not.

*Least squares bias.* The fact that both tests reject the null hypothesis on the coefficients in the second equation is not surprising when we note that the population correlation between  $U_2(t)$  and observed values of  $Y_2(t)$  is 0.56. It is somewhat surprising, however, to find a significant difference in estimates of two structural parameters in the first equation when the population correlation between  $U_1(t)$  and observed values of  $Y_2(t)$  is only -0.016. It could be due to random errors of sampling, of course; however, the correlation between  $U_1(t)$  and  $Y_2(t)$  in sample zero is only -0.023, and it is unlikely that the presence of errors of observation in later samples would change this correlation much. By using determinantal notation and taking mathematical expectations, we can find the L.S. bias in each coefficient. Table VIII gives these biases, classified as shock bias (due to correlation between  $Y_2(t)$  and  $U_1(t)$ ), error bias (due to errors of observation), and total bias.

Why did the  $t$  test reject the null hypothesis on  $b_{12}$  and  $C_{12}$ , coefficients

<sup>4</sup> W. J. Dixon and F. J. Massey, Jr., *Introduction to Statistical Analysis* (McGraw-Hill Book Co., New York), 1951, p. 252.

<sup>5</sup> George W. Snedecor, *Statistical Methods* (4th. ed.; The Iowa State College Press, Ames), 1946, p. 79.

TABLE VIII. LEAST SQUARES BIASES

Parameter	Shock Bias	Error Bias	Total Bias
$b_{12}$	-0.0025	-0.0106	-0.0131
$C_{11}$	.0005	.0002	.0007
$C_{12}$	.0015	-.0464	-.0449
$b_{22}$	.2874	.0267	.3141
$C_{23}$	.0885	-.0283	.0102
$C_{24}$	-0.1774	-0.0027	-0.1801

whose L.S. bias is relatively small? A study of the sample zero estimates and the mean estimates of  $b_{12}$  suggests that the presence of errors of observation reduces the L.S. estimate and raises the L.I.S.E. estimate sufficiently to account for the rejection. Both L.S. and L.I.S.E. estimates of  $C_{12}$  are reduced by the presence of errors of observation. The rejection could be due to the fact that the L.S. estimates undergo a greater reduction.

Given the size of the bias in estimates of  $b_{22}$  and  $C_{24}$ , it is understandable that both tests would reject the null hypothesis concerning their estimates. It is interesting to note that the parameter  $C_{23}$  is also in an equation with high correlation between an explanatory endogenous variable and the disturbance, but its L.S. bias is relatively small when errors of observation are present. Then why did both tests reject the null hypothesis on this coefficient?

The value of  $C_{23}$  is 0.15, the L.S. estimate from sample zero is 0.1596 and the L.I.S.E. estimate is 0.09452; and the mean estimates differed but little from these. So the question is: Is the difference between the sample zero estimates mainly due to random errors of sampling or to L.I.S.E. small sample bias? Some indication that the difference may be due to sample zero's random errors of sampling comes from a study of the correlations (or covariances) between the  $Z_i(t)$  and  $U_i(t)$  in sample zero. Of these eight correlations, one is -0.12, three are -0.16, and one is 0.25, and some of the correlations between the  $Z_i(t)$  and the reduced form shocks are even larger. Each endogenous variable is fitted by least squares (a) to all exogenous variables in the system—the reduced form—and (b) to exogenous variables included in the structural equation. The existence of nonzero covariances attributable to random errors of sampling would affect each set of coefficients and effects could cumulate. This may have happened to the L.I.S.E. estimate of  $C_{23}$ .

The difference between the sample zero estimates might be in part attributable to small sample bias in L.I.S.E. estimates. The author would imagine that this bias would be quite small in samples of 30 observations and this preconception is somewhat bolstered by the observation that each sample zero estimate is within one standard error of its parameter.

TABLE IX. F TEST FOR HOMOGENEITY OF VARIANCES OF L.I.S.E. ESTIMATES FROM SAMPLES ONE TO THIRTY

Coefficient	$s_e^2$	$M_s^2$	F
$b_{12}$	0.0097705	0.0093280	1.047
$C_{11}$	.0030590	.0041809	1.367
$C_{12}$	.0078985	.0095335	1.207
$b_{22}$	.0039419	.012176	3.089**
$C_{22}$	.0018201	.0059017	3.243**
$C_{34}$	0.0047543	0.012525	2.634**

\*\* Significant at the 2 percent level.

*Variances of the L.I.S.E. estimates.* Since the variances are only asymptotically correct, testing the significance of the L.I.S.E. coefficients by the use of the *t* test, as was done here, may not be justified. There may be a significant small sample bias in these standard errors.

The results of this study throw some light on this question. Let us call the variance computed by squaring the standard error accompanying each estimate,  $s_i^2$ ,  $i = 1, \dots, 30$ , and the mean of these variances,  $M_s^2$ . Table II shows the standard deviations computed from the observed distributions of coefficients; call the variances computed by squaring these

n

$s_e^2$ . Define  $\frac{s_e^2}{n-1}$  as  $\bar{s}_e^2$ ; this is an unbiased estimate. The F test for

the homogeneity of variances was applied by taking the ratio of the larger of  $s_e^2$  or  $M_s^2$  to the smaller, with 29 and 26 degrees of freedom, respectively.

As can be observed in Table IX, in only one case was  $s_e^2$  larger; in five cases it was smaller, in three of them significantly so. This suggests that the sample estimates of the variances of the coefficients have an upward bias; they overstate the variance and underestimate the reliability of the coefficients. Now it might be useful to know if this upward bias arises because of something inherent in the method. Table X tabulates the

TABLE X. F TEST FOR EFFECT OF ERRORS OF OBSERVATION ON ESTIMATED L.I.S.E. VARIANCES

Coefficient	$s_e^2$	$M_s^2$	F
$b_{12}$	0.0016436	0.0093280	5.675**
$C_{11}$	.0011922	.0041809	3.693**
$C_{12}$	.0075394	.0095335	1.265
$b_{22}$	.0068014	.012176	1.790
$C_{22}$	.0049469	.0059017	1.193
$C_{34}$	0.010582	0.012525	1.184

\*\* Significant at the 2 percent level.

result of an F test between  $M_s^2$  and  $s_e^2$ , the variance of the estimate in sample zero. In this test,  $M_s^2$  is consistently larger and in two cases significantly so, which indicates that the errors of measurement present in the data contribute substantially to the positive bias of the results. The fact that the significant differences are restricted to coefficients in the first equation might be explained by the fact that the relative variances of the errors of measurement in the variables on the right hand side of that equation are, on the average, 31 percent larger than in the second equation. Also, the single variable with the largest relative error variance is in that equation.

The coefficients of the second equation, whose  $M_s^2$  showed significantly higher in the previous test, do not display a significant upward tendency attributable to measurement errors. This suggests that there is something inherent in the method that tends to induce an upward bias.

TABLE XI. F TEST FOR HOMOGENEITY OF VARIANCES OF L.S. ESTIMATES  
FROM SAMPLES ONE TO THIRTY

Coefficient	$s_e^2$	$M_s^2$	F
$b_{12}$	0.012342	0.018967	1.537
$C_{11}$	.013546	.014239	1.051
$C_{12}$	.014611	.021079	1.443
$b_{22}$	.0083178	.028516	3.429**
$C_{23}$	.0078646	.028014	3.562**
$C_{24}$	0.011815	.030247	2.560**

\*\* Significant at the 2 percent level.

In other words, it appears that the variances have a tendency to overstate the true variances and underestimate the reliability of the coefficients, this upward bias being caused in some cases by the presence of errors of observation, in others by something inherent in the method, and in others by a combination of these two factors.

*Variances of the L.S. standardized regression coefficients.* We can use the same notation as in the preceding section with the understanding that the symbols now refer to standardized regression coefficients.

Table XI shows that  $M_s^2$  is greater than  $s_e^2$  in each case and is significantly larger in three cases. Actually these standard errors do not accurately describe the reliability of the coefficients. The conventional methods of computing standard errors rest on the assumption that the explanatory variables are distributed independently of the random disturbance in the equation. This condition is perhaps sufficiently approximated by the first equation that the standard errors in that equation do describe the accuracy of the coefficients reasonably well. But this assumption of independence is so badly violated in the second equation that the

standard errors would seem to have virtually no meaning. It would be reasonable to suppose that L.S. variances in equations such as (2) would be biased. If this be true, then we might expect significant values of F in these tests.

Even if this is not generally true, the significant values of F for  $b_{22}$  and  $C_{24}$  can be explained on the grounds that these two L.S. coefficients happen to be strongly biased toward zero. In computing the standard errors, the square of the B coefficient is subtracted from another term. On account of this bias toward zero, the square of the B coefficient is too small, thus tending to make the standard error too large.

TABLE XII. F TEST FOR EFFECT OF ERRORS OF OBSERVATION ON  
ESTIMATED L.S. VARIANCES

Coefficient	$s_o^2$	$M_s^2$	F
$b_{12}$	0.0068063	0.018967	2.787**
$C_{11}$	.0048720	.014239	2.993**
$C_{12}$	.0078146	.021079	2.607**
$b_{22}$	.025154	.028516	1.134
$C_{23}$	.025059	.028014	1.118
$C_{24}$	0.027589	0.030247	1.096

\*\* Significant at the 2 percent level.

In Table XII,  $M_s^2$  is larger than  $s_o^2$  for every coefficient and is significantly larger for each coefficient in the first equation. As pointed out previously, we might expect larger values of F for these coefficients since the variables with the larger average relative error variance and the one variable with the largest relative error variance are in this equation.

#### IV. Summary

The tentative findings of this study can be summarized as follows:

(1) The presence of errors of observation imparts little bias to L.S. or L.I.S.E. coefficients, but does increase the standard errors of these coefficients.

(2) The distribution of L.I.S.E. estimates approaches the normal distribution quite rapidly.

(3) The *t* test rejects the null hypothesis on five of the six coefficients; on two ( $b_{22}$  and  $C_{24}$ ) because of their sizeable L.S. bias, on one ( $C_{23}$ ) because of the different impact of sample zero's random errors of sampling on the two methods, and on two ( $b_{12}$  and  $C_{12}$ ) because of the differential effect of errors of observation on the two methods.

(4) The L.S. method can be applied directly to a structural equation having endogenous variables on the right hand side if the covariance between each explanatory endogenous variable and the shock is small. Even in cases in which this covariance is quite high there may be a coefficient

whose L.S. bias is negligible. Unfortunately, in an actual problem we rarely know if either of these situations exists.

(5) The estimated L.I.S.E. standard errors and variances understate the reliability of the corresponding coefficients because of an inherent characteristic of the method, the presence of errors of observation in the data, or a combination of these two factors.

(6) In an equation with moderate or high covariance between an explanatory endogenous variable and the shock term, the L.S. standard errors over estimate the true standard errors.

Before accepting the general validity of these results, there are many points one would want to consider in addition to the question of the effect of sampling errors on these conclusions. However, most of these questions are sufficiently obvious that we do not need to go into them here.

## ESTIMATES OF THE ELASTICITIES OF SUPPLY OF SELECTED AGRICULTURAL COMMODITIES\*

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THIS paper deals with the role that farmers' expectations of future relative prices plays in shaping their decisions as to how many acres to devote to each crop. Although the writer and most previous workers in the field of supply response have concentrated on acreage decisions, it should be recognized at the outset that acreage response to price is only one facet of the much more complicated problem of obtaining a comprehensive supply function. Within this limited context I shall try to answer two questions: First, why have such low elasticities of acreage to deflated price been obtained? Second, is it possible to obtain measures of the elasticities that are more in line with what we know from studies made on production functions and on farmers' reactions to the allotment and price support programs? In connection with this second question, I shall present a few tentative and preliminary estimates of the elasticity of acreage to deflated price for cotton, wheat and corn, for the period 1909-32.

### I

Many fewer studies have been made on the response of supply to price in comparison with the number of studies on demand. What little work that has been done is mainly for agricultural products. The more important of these studies are those of Bradford Smith, Louis Bean, Robert Walsh, and R. L. Kohls and Don Paarlberg.<sup>1</sup> All these studies suggest that farmers respond very little to price in planning their acreage. The most intensively investigated commodity has been cotton. Walsh found that the elasticity of acreage with respect to last year's deflated price, while

\* Based on an investigation of the relationship of acreage to deflated price for cotton, wheat and corn, during the period 1909-1932.

This paper is a preliminary report on research still in progress. Subsequent findings may alter the conclusions reached.

\*\* I wish to acknowledge the financial and computational assistance of the Social Science Research Council, the Earhart Foundation, and the Department of Economics at the University of Chicago. I am deeply grateful to Professors C. F. Christ and A. C. Harberger, both of the University of Chicago, for many stimulating comments and criticisms on earlier drafts of this paper and on the research upon which this paper is based. I alone, however, am responsible for any errors that occur.

<sup>1</sup> Bradford B. Smith, *Factors Affecting the Price of Cotton*, USDA Tech. Bul. 50 (Washington: 1928); L. H. Bean, "The Farmers' Response to Price," *Jour. Farm Econ.*, Vol. 11 (1929), pp. 368-85; Robert M. Walsh, "Response to Price in the Production of Cotton and Cottonseed," *Jour. Farm Econ.*, Vol. 26 (1944), pp. 359-72; R. L. Kohls, and Don Paarlberg, *Short-Time Response of Agricultural Production to Price and Other Factors*, Purdue Univ. Agri. Expt. Sta. Bul. 555 (1950).

significantly greater than zero, was of the order of only 0.2. Kohls and Paarlberg estimated an elasticity of acreage with respect to price of about 0.07 for corn and 0.2 for wheat. In a number of regressions of acreage on deflated price lagged one year and trend, for the period 1909-32, I have obtained similar results. The results of Smith and Bean cannot conveniently be summarized by a single numerical measure of elasticity.

These numerical estimates seem to be contradicted by experience under the support programs. In 1948, about 36% of the cotton crop, 28% of the wheat crop, and 15% of the corn crop was placed under loan. The estimates of the elasticities of demand for these three crops are quite low: between - .3 and 0 for cotton and wheat, and less than - 1 for corn.<sup>2</sup> If the supply elasticities are as low as previous measurement would suggest, then support prices for cotton, wheat, and corn must have been greatly in excess of the equilibrium prices in 1948. On the other hand, somewhat higher elasticities of supply would not imply support prices that were greatly out of line with the equilibrium prices. It is difficult to believe that the supported cotton price was 70% above the equilibrium price, the supported wheat price 50-60%, and the supported corn price more than 15%.<sup>3</sup> It seems far more reasonable that supply elasticities are higher than previous measurement would suggest.

<sup>2</sup> See Frank Lowenstein, and Martin S. Simon, "Analyses of Factors That Affect Mill Consumption of Cotton in the United States," *Agri. Econ. Res.*, Vol. 6 (1954); Kenneth W. Meinken, *The Demand and Price Structure for Wheat*, USDA Tech. Bul. No. 1136 (1955), pp. 42-43; and Richard J. Foote, John W. Klein, and Malcolm Clough, *The Demand and Price Structure for Corn and Total Feed Concentrates*, USDA Tech. Bul. No. 1061 (1952), pp. 39-41.

<sup>3</sup> These figures were crudely derived on the basis of the following considerations:

Let  $q$  = the quantity produced;

$P_0$  = the equilibrium price;

$P + \Delta P$  = the support price;

$\frac{\Delta q}{q}$  = the quantity placed under loan as a percent of the total crop.

The elasticity of demand  $\epsilon$  is approximately equal to

$$-\frac{\Delta q/q}{\frac{\Delta P}{P_0}}.$$

Therefore, if the elasticity of supply is close to zero, the excess of the support price over the equilibrium price is

$$\frac{\Delta P}{P_0} = \frac{\Delta q/q}{\epsilon}.$$

If the elasticity of supply is not zero but  $\eta$ , we have

$$\frac{\Delta P}{P_0} = \frac{\Delta q/q}{\epsilon + \eta},$$

where all elasticities are measured from the disequilibrium quantity actually produced.

Estimates of farm production functions give additional reason to question previous estimates of the elasticities of supply. Heady has found that, on the individual farm, substitution among crops is relatively easy.<sup>4</sup> This means that on typical farms small changes in the relative prices of crops may make large changes in the cropping practices profitable. Beneke and Howell have investigated Iowa farmers' reactions to corn acreage allotments.<sup>5</sup> They find that farmers not participating in the allotment program increased substantially the acreage they planted to corn, at the expense of soybeans and other crops. Presumably these farmers shifted because they could anticipate that a combination of both the supports for corn and the existence of allotments would make it profitable for them to do so. Individual farmers, then, *can* and *do* shift when conditions make a shift profitable. This fact suggests that there may be substantial response to price in the production of individual crops.<sup>6</sup>

One reason why such low estimates may have been obtained may be that the elasticity of supply has been identified with the elasticity of acreage with respect to price. The elasticity of acreage is probably only a lower limit to the supply elasticity. More important, though, is the fact that price lagged one year has been identified with the price to which farmers react, i.e., the price that they expect will prevail at some future time. Kohls and Paarlberg have pointed out that farmers would not be acting in their own interest if they did, in fact, take last year's price as an indication of what this year's price was going to be.<sup>7</sup> I think we would all agree—after all, agricultural prices are among the most volatile in the economy. Farmers would probably find themselves with lower incomes if they extensively revised their production plans in response to the wide swings that take place in the relative prices of various crops. Surely farmers must base their decisions on some reasonable assessment of the supply and demand conditions for the commodities they produce. *Farmers react, not to last year's price, but rather to the price they expect, and this expected price depends only to a limited extent on what last year's price was.*

<sup>4</sup> E. O. Heady, "The Supply of U. S. Farm Products under Conditions of Full Employment," *Amer. Econ. Rev.*, Vol. 45, No. 2 (May 1955), p. 230.

<sup>5</sup> R. R. Beneke and H. B. Howell, "How Do Farmers React to Corn Acreage Allotments?" *Iowa Farm Science*, Vol. 10 (October, 1955).

<sup>6</sup> High elasticities of substitution on individual farms do not, however, necessarily entail a high elasticity of supply for the industry as a whole. The extent of change of relative prices may have to be very great before any substantial number of farms will shift. The more diverse are the farms with regard to the suitabilities of their lands and managements for production of various crops, the lower will be the elasticity of supply. With high elasticities of substitution among crops, however, we must assume almost unreasonable diversity among farms in order that the observed elasticities of supply be as low as previous studies have indicated.

<sup>7</sup> Kohls and Paarlberg, *op. cit.*, p. 7.

## II

In taking the position that we should not identify expected price with price lagged one year, we are letting ourselves in for trouble. In theory we can always find out what today's expected prices are by asking farmers; but we cannot find out what expected prices were in the 'twenties by asking the farmers of 1955. In practice, therefore, we cannot observe expected prices. If we do not identify expected price with last year's price, with what, then, can we identify it? If you will grant that we can use the elasticity of acreage with respect to expected price as a measure of the elasticity of supply, then this question is really the second question posed at the beginning of this paper: Can we obtain more reasonable estimates of the elasticities of supply?

If more specific information is not available, it seems reasonable to assume that the price expected to prevail at some future date depends in some way on what prices have been in the past. Price expectations are, of course, shaped by a multitude of influences, so that a representation of expected price as a function of past price may merely be a convenient way to summarize the effects of these many and diverse influences. In some situations certain influences may be controlling, and in those situations we should utilize what knowledge we have of the controlling influence to take account of it directly. For example, it is difficult to believe that the operations of the Commodity Credit Corporation can have failed to exert an influence on price expectations far in excess of those factors whose influences may be summarized by past prices. Because of the special difficulties presented by the support programs and the acreage allotments, this discussion will be confined to the period before 1933.

How should we use past prices to represent expected price? Each past price represents only a very short-run market phenomenon, an equilibrium of those forces present in the market at the time. It is for precisely this reason that farmers may not react only to last year's price. This does not mean, however, that the past has no relevance for the future. I think it can be said in general that more recent prices are a partial result of forces expected to continue to operate in the near future: the more recent the past price, the more it expresses the operation of those forces relevant to expectations. Hence, I assume that the influence of more recent prices should be greater than the influence of less recent prices. What could be simpler than to represent expected price as a weighted moving average of past prices in which the weights decline as one goes back in time?

The practice of representing expected price by price lagged one year is clearly a special case of this more general hypothesis. In the special case a weight of one is arbitrarily assigned to last year's price and zero

weight to all other prices. In allowing for the possibility that the weights for prices other than last year's price are not zero, we should use farmers' behavior to help us decide on an appropriate weighting system. We clearly do not have enough observations on the acreages devoted to major field crops to permit us to include prices separately back to Adam and Eve in a multiple regression of acreage on past prices. The sensible procedure readily suggests itself: Why not restrict the form of the weighting system but allow the actual values of the weights to be determined by the data? Since, for any declining weight system, prices beyond a certain point in time exert only a negligible influence in total, we can economize the available degrees of freedom, estimate the elasticity of acreage with respect to expected price, and determine the number of past prices influencing expected price; and we can do these things all at the same time.

There are many forms we might give to a weighting system such as I have described. How can we settle on a particular form? We might obtain a sensible form for the weighting system by beginning a bit farther back with some very specific hypothesis about the way in which expectations are formed and then *deriving* the result that expected price may be represented by a weighted moving average of past prices. One such hypothesis that seems plausible to me, but which is by no means the only possibility, is that *each year farmers revise the price they expect to prevail in the coming year in proportion to the error they made in predicting price this period.*<sup>8</sup> Let us denote the price expected this year by  $P_t^*$ , the price expected last year by  $P_{t-1}^*$ , the actual price last year by  $P_{t-1}$ . Let the proportion of the error by which farmers revise their expectations be a constant,  $\beta$ , which lies between zero and one. I shall call  $\beta$  the coefficient of expectation. The hypothesis just stated can be expressed mathematically as follows:

$$(1) \quad P_t^* - P_{t-1}^* = \beta [P_{t-1} - P_{t-1}^*], \quad 0 < \beta \leq 1.$$

Let me illustrate the meaning of this hypothesis with a numerical example. Suppose that farmers expected a price of \$2.00 per bu. of wheat this year but that the realized price was only \$1.90. Shall they now immediately reach the conclusion that their previous prediction had no value whatsoever, that the best they can do is to predict a \$1.90 for next year? If we agreed with the procedure usually followed, namely that of arbitrarily assigning unit weight to last year's price and zero weight to all other prices, we would have to say that farmers placed no faith at all in their previous predictions. Farmers as a group, however, are known

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\* Substantially the same hypothesis was originally developed by Phillip Cagan in *The Monetary Dynamics of Hyper-Inflations*, unpublished Ph.D. dissertation, the University of Chicago (March, 1954). Only minor modifications are necessary in order to apply Cagan's formulation to the problems under consideration in this paper.

for the strength of their convictions. Some farmers might revise their expectation downward from \$2.00 to \$1.90, but I suspect that most farmers would revise their expectations down only, let us say, to \$1.95. Some farmers might not revise their expectations at all. In this case the average expected price might turn out to be \$1.94, so that the magnitude of the coefficient of expectation would be 60% for the group as a whole.

It can be shown that the hypothesis, stated in equation (1), that farmers revise the price they expect in proportion to the error they have made in prediction, is equivalent to one in which expected price is represented as a weighted moving average of past prices where the weights are functions solely of the coefficient of expectation.<sup>9</sup> Mathematically the result is as follows:

$$(2) \quad P_t^* = \beta P_{t-1} + (1 - \beta)\beta P_{t-2} + (1 - \beta)^2\beta P_{t-3} + \dots$$

The variables have the same meaning as before. Since the coefficient of expectation,  $\beta$ , is between zero and one the weights will decline toward zero as we go back in time. Although in theory *all* past prices must be included, the fact that the weights decline means that practically we can safely ignore prices in the very distant past. At just what point in the past we can safely begin to ignore all previous prices depends on the size of the coefficient of expectation: the closer is the coefficient of expectation to zero, that is, the greater the tenacity with which farmers cling to their previous expectations, the greater will be the number of past prices we cannot ignore. When the coefficient of expectation is 50%, we must include about the five past actual prices to come within 5% of the expected price.<sup>10</sup> Taking account of five past prices is certainly quite different from taking account of only one past price.

We can use the hypothesis that farmers revise their expectations by a portion of the error they make in prediction to obtain estimates both of the elasticity of acreage to expected price and of the coefficient of expectation. Let us restrict ourselves to the simple case in which the acreage devoted to a crop is a linear function of the expected relative price of that crop alone. We might in practice wish to include a trend variable, but for the purpose of this exposition I shall leave it out. Let  $x_t$  be acreage this year,  $P_t^*$  be the price expected this year, and  $u_t$  be a random residual

<sup>9</sup> This result may easily be derived by recognizing that equation (1) is a first order difference equation in expected price. On the assumption of the appropriate initial conditions, it will be found that the solution to the difference equation is the same as that given in equation (2) below.

<sup>10</sup> The sum of weights for a number  $N$  of past prices is

$$1 - (1 - \beta)^{N+1}$$

The number of past prices that should be included in order that the approximate error be less than or equal to some small positive amount  $e$  can be found from the following formula:

$$|1 - (1 - \beta)^{N+1}| \leq e.$$

term. Then we can write the acreage response function as follows:

$$(3) \quad x_t = a_0 + a_1 P_t^* + u_t.$$

We cannot observe  $P_t^*$  and so we cannot estimate equation (3) quite as we would any other simple equation. We must represent  $P_t^*$  in terms of variables we can observe. Equation (3) means that we can write any expected price,  $P_t^*$ , as a linear function of acreage  $x_t$ . In particular, last year's expected price,  $P_{t-1}^*$ , can be represented by last year's acreage,  $x_{t-1}$ . But this means that expected price this year is a function of last year's actual price and last year's acreage. Why? Because our expectation model, as expressed in equation (1), says that expected price this year is a function of actual price last year and expected price last year. We can replace last year's expected price in equation (1) by a linear function of last year's acreage. If we now substitute this new expression for expected price into the acreage response function, equation (3), we obtain a new relation between acreage this year and last year's actual price and last year's acreage. It is

$$(4) \quad x_t = \pi_0 + \pi_1 P_{t-1} + \pi_2 x_{t-1} + v_t,$$

where  $v_t$  is a random residual different from  $u_t$ .  $\pi_0$  turns out to be equal to  $a_0\beta$ ,  $\pi_1$  equals  $a_1\beta$ , and  $\pi_2$  equals  $1 - \beta$ .<sup>11</sup> We cannot, in practice, observe expected price, but we can observe last year's price and last year's acreage. Hence, if acreage really does respond to expected price we should observe a correlation between acreage this year and actual price last year and acreage last year. The relationship between the  $\pi$ 's in equation (4) and the  $a$ 's and the  $\beta$  in equation (3) allows us to work back from equation (4) to the acreage response function expressed by equation (3).<sup>12</sup>

<sup>11</sup> This method of transforming the original acreage response function was suggested by the work of L. M. Koyck on *Distributed Lags and Investment Analysis* (North-Holland Publishing Co.: Amsterdam, 1954), chap. II. Koyck, however, postulates the existence of a distributed lag, whereas equation (1) above explains its existence. The advantage of using two relationships, such as (1) and (3), to obtain (4) rather than obtaining (4) from a relationship such as

$$x_t = a_0 + a_1 [\beta P_{t-1} + (1 - \beta) \beta P_{t-2} + \dots] + u_t,$$

is that it is still possible to perform this same kind of transformation on the acreage response function when more than one expected price is included. When the coefficients of expectation for different crops are not restricted to be the same, however, it is necessary to transform the whole set of all related acreage response functions simultaneously. It is then also necessary to estimate all such transformed relations in order to estimate the coefficients in any one of the original response functions. A great advantage of this method is, however, the ease with which we can make the change in expected price depend on factors other than the error of prediction (i.e., past prices). For example we might wish to take account of the influence of anticipated changes in livestock numbers on the expected price of corn.

<sup>12</sup> A major difficulty exists in interpreting the results of a regression of acreage on lagged price and lagged acreage: In the discussion in the text, a relationship between

At this point a parenthetical remark about the statistical properties of the estimates we obtain from an equation relating this year's acreage to last year's actual price and last year's acreage should be inserted. Most economic time series are known to exhibit a great deal of serial correlation. Normally, in estimating an equation like (3), we would assume that the residuals  $u_t$  were not serially correlated. Suppose for the moment that we could observe  $P_t^*$  and we went ahead and estimated equation (3). If the residuals  $u_t$  were positively serially correlated our estimates of the coefficients in equation (3) would be biased and statistically inconsistent. The residuals  $v_t$  of equation (4) will be serially uncorrelated only if the residuals  $u_t$  are positively serially correlated.<sup>13</sup> Hence, estimates of  $a_0$  and  $a_1$  derived from equation (4) may be better estimates than those we would obtain if we could observe  $P_t^*$  independently.<sup>14</sup>

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acreage and expected price, (3), and a relationship between expected prices and past prices, (1) or (2), are assumed; on the assumption that *observed* acreage represents *desired* acreage, equation (4) is derived. Alternatively, we might assume that expected price was equal to last year's price, but that *desired* acreage was not the same as observed acreage. In order to make these hypotheses operational we would have to assume some relation between desired and actual acreages. For example,

$$(1') \quad x_t^* - x_{t-1} = \gamma [x_t - x_{t-1}],$$

where  $x_t^*$  = desired acreage,  $x_t$  = actual acreage, and  $\gamma$  = a constant. (1') states that the change in actual acreage is proportional to the difference between desired and actual acreage. If we assume the particular relation stated in (1'), we find that acreage is again a linear function of lagged price and lagged acreage, only  $\gamma$  now enters where  $\beta$  did before. Hence, estimation of equation (4) cannot distinguish between two cases: (1) actual acreage is equal to desired acreage, but expected price is not equal to last year's price, and (2) desired acreage is not equal to actual acreage, but expected price is equal to last year's price. The difficulty inherent in the interpretation of equation (4) of the text is common to all empirical work in economics. Theory does not always provide us with relationships between variables which can be observed. Further relations between the nonobserved variables and other variables that can be observed must be postulated. Only then can we test hypotheses concerning the theoretical relationship. Additional empirical evidence must be brought to bear on the problems of how strongly farmers react to actual prices in altering their expectations and how rapidly they react to expected prices in the adjustment of actual acreage to desired acreage.

<sup>13</sup> In order that the residuals  $v_t$  be serially uncorrelated, the residuals  $u_t$  must follow an auto-regressive scheme of the following sort:

$$u_t = (1 - \beta) u_{t-1} + \varepsilon_t,$$

where  $\varepsilon_t$  is randomly and independently distributed and  $\beta$  is the coefficient of expectation. To assume that this is so, is no worse an assumption than to assume no serial correlation among the  $u_t$ .

<sup>14</sup> If the residuals  $u_t$  are actually uncorrelated serially, the residuals  $v_t$  should be negatively serially correlated. Tests I have made, however, on the calculated residuals  $v_t$  do not indicate significant negative serial correlation. (See the table below.)

Another method for estimating the coefficients in equation (3) and the coefficient of expectation is available. This method rests on the assumption that the residuals  $u_t$  are *not* serially correlated. An alternative way of looking at expected price is that it

In the table below some of the main empirical results are summarized and compared. The results obtained from the regressions of acreage on lagged deflated price and trend are summarized in column (2). These regressions were carried out for three crops, cotton, wheat and corn, for the period 1909-32. The estimates of the elasticities, coefficients of trend and the multiple correlation coefficients are comparable with such estimates that have been obtained by other workers in the field of supply

is a weighted moving average of past prices where the weights are determined by the coefficient of expectation. If we knew the coefficient of expectation we could calculate all the expected prices using past actual prices. If we tried a number of different values for the coefficient of expectation we could find a value that would yield the greatest correlation between acreage and expected price. In this way we could obtain estimates of both the coefficient of expectation and the elasticity of acreage response. By stepwise maximization of the likelihood function we can show that this iterative procedure yields maximum likelihood estimates, provided the residuals  $u_t$  are not serially correlated. Confidence intervals for the estimates would be very difficult to obtain, but any point hypothesis can be tested by means of the likelihood ratio.

This procedure has been used to obtain estimates of the elasticities of acreage with respect to expected price. The estimated elasticities, the multiple correlation coefficients and the estimates of  $\beta$  are presented in the table below.

Crop	Elasticity of acreage with respect to expected price	Coefficient of expectation $\beta$	$R^2$	Durbin-Watson Statistic	
				(5)	(6)
(1)	(2)	(3)	(4)	(5)	(6)
Cotton	4.53	0.04	0.80	1.71 <sup>a</sup>	2.34 <sup>a</sup>
Wheat	1.18	0.37	0.77	1.25 <sup>b</sup>	2.19 <sup>a</sup>
Corn	0.35	0.25	0.43	1.54 <sup>b</sup>	2.04 <sup>a</sup>

<sup>a</sup> Insignificant serial correlation at the .05 level.

<sup>b</sup> Durbin-Watson test inconclusive at the .05 level.

The values of the Durbin-Watson statistic, used for testing for the presence or absence of serial correlation, are given in column (5) for the results obtained by the iterative procedure under discussion. These values are given in column (6) for the results obtained by the procedure discussed in the text. The Durbin-Watson Test does not appear powerful enough to distinguish between the iterative and noniterative procedures: the statistic indicates insignificant negative serial correlation among the residuals  $v_t$  obtained by the noniterative procedure, but it also indicates that the hypothesis of no positive serial correlation among the residuals  $u_t$  cannot be rejected. It should be noted, however, that the estimates of the coefficients of expectation obtained by the iterative procedure are unreasonably low and also quite different from one another. The rather strange results obtained by the iterative procedure may be due in part: (1) to the presence of positive serial correlation among the  $u_t$ ; and/or (2) to the presence of a lag in the adjustment of actual to desired acreage in addition to the lag in the adjustment of expected to actual price; and/or (3) to the presence of additional variables that should have been, but were not, taken into account in the acreage response function. The estimates of the elasticities obtained by the iterative procedure are higher than those obtained by the noniterative (see the table in the text). These higher estimates correspond to the lower estimates of the coefficients of expectation.

response. I have called the procedure, which yields the estimates summarized in column (2), the "special" method, because it rests on the arbitrary assumption that the coefficient of expectation is one. Column (3) summarizes the results obtained from the regressions of acreage on lagged deflated price, trend, and lagged acreage. I have called the procedure, which yields these estimates, the "general" method, because it allows the data to determine the coefficients of expectation.

The main things we want to compare between the special and general methods are: (1) the magnitudes of the elasticities of acreage to expected price; and (2) the percentage of the variance of acreage explained, i.e., the  $R^2$ 's. The squares of the multiple correlation coefficients are substantially higher using the general method than they are using the special method. Dropping the arbitrary assumption that the coefficient of expectation is 1 leads to an increase in the  $R^2$  of .15 for cotton, .13 for wheat and .13 for corn.<sup>15</sup> The general method also yields estimates of the elasticities of acreage to expected price that are two to three times as large as those yielded by the special method.<sup>16</sup> See Table I. Earlier in the

TABLE I. A COMPARISON OF TWO METHODS (SPECIAL AND GENERAL) FOR ESTIMATING THE ELASTICITY OF SUPPLY AS MEASURED BY THE RESPONSE OF ACREAGE TO EXPECTED PRICE FOR COTTON, WHEAT AND CORN (1909-32)

Crop and Magnitude Compared	Special Method [Restricted $\beta$ : ( $\beta=1$ )]	General Method [Unrestricted $\beta$ ]
(1)	(2)	(3)
Cotton:		
Elasticity	0.20	0.67
Coefficient of expectation ( $\beta$ )	1.0	0.51 ( $\pm .17$ )
$R^2$		
Trend	0.59 0.48 ( $\pm .10$ )	0.74 0.18 ( $\pm .12$ )
Wheat:		
Elasticity	0.47	0.93
Coefficient of expectation ( $\beta$ )	1.0	0.52 ( $\pm .14$ )
$R^2$		
Trend	0.64 1.08 ( $\pm .17$ )	0.77 0.53 ( $\pm .17$ )
Corn:		
Elasticity	0.09	0.18
Coefficient of expectation ( $\beta$ )	1.0	0.54 ( $\pm .24$ )
$R^2$		
Trend	0.22 0.21 ( $\pm .10$ )	0.35 0.16 ( $\pm .11$ )

(The figures in parentheses below the estimates are the standard errors of the estimates.)

<sup>15</sup> These increases are all significant at the .05 level or better.

<sup>16</sup> It should be noted that the results obtained by the general method are consistent

paper I indicated why I thought a higher estimate of the elasticity was preferable to a lower estimate. Qualitatively, at least, the estimates obtained by the general method are more reasonable than those obtained when the coefficient of expectation is arbitrarily assumed to be one.<sup>17</sup>

It is also especially interesting to note the decrease in the significance of the trend variable in explaining acreage when we allow the coefficient of expectation to be determined by the data. The necessity of including a trend, that is to say the finding of a significant trend, is tantamount to an admission of ignorance, ignorance of either the relevant trend-causing factors or of the whereabouts of data by which to measure the force of these factors. To the extent to which the use of the general method leads to a reduction in the ratios of the trend coefficients to their standard errors, we have reduced our ignorance.<sup>18</sup>

### III

The explanation of changes in corn acreage is substantially poorer than the explanations of changes in the acreages devoted to cotton and wheat. It is sometimes said that the price of livestock products is more influential in determining corn acreage than corn prices are. Such a statement is, I believe, incorrect. The price of livestock products is a factor determining the demand for corn and not its supply. The expected level of future livestock prices would reflect itself in the expected price of corn. A large differential between the price at which a farmer can sell corn and the price at which he can buy corn to feed his livestock would tend to reduce the elasticity of supply of corn, but such a differential will not introduce a factor that is really in the demand function into the supply function as well. The difficulty with corn is probably due in large part to the fact that corn is harvested after or during the period when winter wheat is planted.

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with those obtained by the special method. When we use the special method what we really estimate is the elasticity of acreage times the coefficient of expectation; hence, the estimates of the elasticities obtained by the general method should be about twice as large as those obtained by the special method, if the coefficient of expectation is about 50%.

<sup>17</sup> The estimates of  $\beta$  (none significantly different from 0.50) indicate that five or more past prices should be used to approximate expected price. A somewhat more restrictive approach would be to assume that expected price was a weighted moving average of the last two past prices where the weights are determined by including prices lagged one and two years in a regression with acreage. This restriction might be justified by the following model of expectation formation:

$$P_t^* - P_{t-1}^* = \alpha [P_{t-1} - P_{t-2}], \quad |\alpha| \leq 1.$$

As might be expected this model does less well in explaining acreage than the more general model.

<sup>18</sup> The ratio of the trend coefficient to its standard error falls, in passing from column (2) to column (3), from 4.8 to 1.5 for cotton, from 6.0 to 3.1 for wheat, and from 2.1 to 1.5 for corn.

Corn and winter wheat compete for acreage throughout the Corn Belt. When deciding how much acreage to plant to winter wheat, the farmer must also decide how much he will later plant to corn. In addition, he is restricted in his decision by the fact that it is difficult for him to plant acres on which corn is still standing. Corn price lagged one year appears to be less relevant to the determination of expected corn price than does the price lagged two years.<sup>19</sup>

Another factor that may influence price expectations is the existence of the Commodity Credit Corporation, which has introduced an entirely new element into the problem of how farmers form their expectations of future prices. The loan rates on various crops are generally known by farmers before they make their final decisions on what to plant. Actual prices at harvest may, of course, be higher than the support level and they may even fall below it when sufficient storage facilities are not available in the immediate vicinity of farmers. In spite of this fact, it seems to me that the level of support will be the best available indication at planting of what prices will be at harvest. The Commodity Credit Corporation has probably been instrumental in raising the levels of expected prices for corn, cotton and wheat relative to price levels of other agricultural products not included in the support programs, or whose prices are supported at a lower percentage of parity.

In addition to raising the level of expected price, the Commodity Credit Corporation has probably reduced the price uncertainty that farmers face. Such a reduction in uncertainty would probably lead to decreased capital rationing and a better allocation of resources between agriculture and the rest of the economy, as Professor D. Gale Johnson has shown.<sup>20</sup> Both the higher level of prices and reduced capital rationing would have the effect of speeding up the adoption of new and better techniques of agricultural production.<sup>21</sup> Many economists have observed (1) a great increase in yields, when acreage has been restricted; and (2) an increase in acreage, when acreage has not been restricted. Those that believe that the elasticities of supply are low have argued that both these increases in yields and increases in acreage have been a result solely of shifts in the supply schedules caused by forces set in motion by the

<sup>19</sup> When corn acreage is regressed on corn price lagged two years, corn acreage lagged one year, and trend, an  $R^2$  of 0.43 is obtained. Corn price is highly significant and its coefficient indicates an elasticity of acreage with respect to expected corn price of 0.23. These considerations indicate that it is highly important to take careful account of harvesting and planting times. The competition between corn and winter wheat will be more thoroughly investigated in future research.

<sup>20</sup> D. Gale Johnson, *Forward Prices for Agriculture* (Chicago: University of Chicago Press, 1947).

<sup>21</sup> See W. W. Cochrane, *An Analysis of Farm Price Behavior*, Penn. State College Agri. Expt. Stat. Progress Report No. 50 (May 1951), pp. 33-37.

policies of the Commodity Credit Corporation. The evidence presented in this paper suggests that the elasticities of supply are considerably higher than previous measurements indicate. If the elasticities of supply are higher, a large part of the alleged shifts in the supply schedules may be explained simply on the basis of the fact that the Commodity Credit Corporation has raised the levels of expected price and, thus, farmers have more or less moved along the original schedule that relates supply to expected price. Since shifts in the supply schedule due to decreased capital rationing and adoption of new techniques of production are likely to be largely irreversible, it seems worthwhile to find out how much of the alleged shift in the supply schedules is in reality due only to increases in the levels of expected prices. This means that analyses carried out for the period before 1933 should be applied to the period after 1933. Thus, in order to assess the effects of the Commodity Credit Corporation on capital rationing and technological change, we will first have to assess its effects on price expectation formation.

#### IV

At the beginning of this paper two questions were posed: First, why have such low elasticities of acreage with respect to price been obtained? And second, how is it possible to obtain elasticities of supply more in line with our experience with price supports and more compatible with the results of the studies on production functions and farmers' reactions to the allotment programs? The answer given to the first question was that previous estimates of the elasticity of acreage response to price have been based on the arbitrary and possibly incorrect assumption that the expected price is last year's price. The answer to the second question was that by making a more general assumption about price expectations it is possible to obtain higher elasticities of *acreage* response to price; and, insofar as the elasticity of acreage with respect to price represents a lower limit to the elasticity of supply, higher and more reasonable estimates of the elasticity of supply are implied.

Obviously the method presented in this paper is not a panacea for all problems connected with the estimation of supply functions for agricultural products. Good estimates of the elasticity of supply response to price can be obtained only from comprehensive supply functions. This means that at least the expected prices of alternative outputs and the expected prices of variable inputs must be taken into account. In addition, the responsiveness of yields to various prices must be investigated, and the role of technological change must be examined. The way in which farmers form their expectations of future prices is only one facet of the complex and interesting problem of measuring supply response, but I believe it is an exceedingly important facet. The method that has been

presented for obtaining expected price in an operational manner is only one of possibly many such methods. I do not want to assert that it is the best one. What I do assert is that consideration of the role that expectations of future price plays in shaping farmers' decisions is not a trivial nor an unimportant occupation. More sophistication in the matter of price expectations will help us greatly in estimating supply functions and will reduce the amount of sophistication necessary to the solution of the other problems involved in the development of comprehensive supply functions for agricultural commodities.

#### DISCUSSION: ESTIMATES OF THE ELASTICITIES OF SUPPLY OF SELECTED AGRICULTURAL COMMODITIES

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The paper presented by Marc Nerlove emphasizes the need for reconsideration of results obtained from statistical estimates of supply response from time series data. He has made a substantial contribution in the formulation and application of price expectations models to the estimation of supply, or acreage response for wheat, cotton and corn for the period 1909-32. His position is that many statistical estimates of supply response have been too low, for certain commodities, because of incorrect formulation of the price factor to which farmers react. More specifically, "farmers react, not to last year's price, but rather to the price they expect, and this expected price depends only to a limited extent on what last year's price was." The alternative formulation that he explores most fully is that "farmers revise the price they expect to prevail in the coming year in proportion to the error they made in predicting price this period."

I fully agree with the conclusions as to the importance of the role of expectations of future prices in farmers' supply response; not only the price of that single commodity, but the prices of alternative outputs, the factor costs of the alternative enterprises, and the alternative employment possibilities of the factors, including the operator himself. In brief, the comprehensive supply response study requires knowledge of the production functions underlying various enterprises, factor and product prices, and the conditions and rapidity with which farmers will react to seemingly more profitable production, as well as the ever present problem of technological change. This problem of trying to predict probable supply response has been tackled by various methods, such as budget analysis of modal-type farms, linear programming, and analyses of farm records, as

well as by the analysis of time series data, and the usefulness of limitations of the various approaches are probably well known. I would, therefore, like to make a few comments on certain aspects of this particular expectations model and on the possible impact of certain factors that cannot be readily specified in the model.

Several difficulties have been mentioned, such as the relative profitability of alternative enterprises, the regional aspects of spring and winter wheat, for example, and I understand Nerlove has experimented with some of these aspects of the problem. One of the most important aspects of supply response, I believe, is to consider how response differs under varying conditions of the economy as a whole and of alternative farm enterprises. The operations of the CCC have undoubtedly exerted some effect on farmers' acreage and supply response, but the period of 1909 to 1932 also has some interesting differences in it. D. Gale Johnson had some pertinent comments in "The Nature of the Supply Function for American Agriculture" in the *American Economic Review* of September 1950, as did Robert Clodius in a note on "The Theory of the Kinked Output Path Response" in the *Journal of Farm Economics* of August 1953, as to the probable irreversible nature of the supply curve under certain conditions.

Over the 24-year period included in this analysis, there was an 11-year period, from 1909-19, of prosperous times with real farm prices rising during World War I; then a drop-off in 1920-22; a period of stable farm prices and prosperous times for the rest of the economy from about 1923-29; and then the depression period following. The type of acreage or supply response to price would be expected to vary considerably as between a period of fairly high, or rising, levels of real prices, and a period in which all prices were dropping sharply. For certain crops such as corn, for example, farmers might have found it more profitable to maintain acreage and cut variable expenses during a period of declining economic activity such as 1929-33. The fact that acreage was increased during this period cannot be taken, of itself, as an indication of a negatively sloped farm supply curve since many of these farmers coordinate corn acreage with livestock enterprises to a large extent, but it seems to be a good indication that the short-run supply curve may be very inelastic in acreage response on the downturn, especially if production alternatives are limited.

It is interesting to note that the values of  $\beta$  for corn, wheat and cotton were all about 0.50 when estimated by the method outlined, but very low values of  $\beta$  were obtained by the alternative procedure noted in footnote 12. Nerlove points out that the method presented in the text may work more accurately under circumstances where there is difficulty in

specifying all the relevant variables. This raises the problem under what circumstances these results indicate only acreage response and to what extent they reflect other factors known to influence supply. One of the important factors affecting the difference between what a farmer expected for a price, and what he received, is unusual yields. Probably acreage planted is based on the assumption of an expected price, assuming "normal" conditions. It would be interesting to determine to what extent the  $\beta$  value in this model is due to price correction due to abnormal yields. For example, the year singled out by Nerlove, 1948, was a year when corn yields were about 20% above trend.

The use of deflated prices introduces problems in assuming that farmers used this same deflator in arriving at their expectations as to price. In this formulation, however, it is a necessary limitation. The use of past year's price and past year's acreage probably does not introduce a high degree of intercorrelation between these variables for these crops, but it is conceivable that for some crops this would be an added problem. The reduction of the trend coefficients for cotton and wheat by inclusion of the past year's acreages may be due to the movement of these series over the period studied. Also the lack of data on planted acreage for wheat prior to 1919 and for corn prior to 1929 may give some additional limitation to the results. However, I should like to emphasize that I think Nerlove has made a substantial advance to supply analysis in this paper, and I am looking forward to seeing a more detailed summary of this very interesting research.

The paper presented by Suits and Koizume on "The Dynamics of the Onion Market" has three interesting aspects; namely, (1) an analysis of the unharvested portion of the crop; (2) an analysis of the dynamics of the market; and (3) an attempt to get into the regional pattern of production with consideration of competing crops included in the analysis.

In the analysis of a crop such as onions there is need to distinguish among the early, intermediate and late crops, since production is definitely regional and the types of competing crops may vary considerably. Data on the proportion of the crop not harvested for economic reasons (as reported by Crop Estimates reports from 1928 to date) indicate that for the early and intermediate crops an average of 3 percent was not harvested, and for the late crop about 1 percent was not harvested.<sup>1</sup> There was considerable variation among years. The relationship shown here seems to give a fairly good prediction for the entire crop. To the extent that late onions generally amount to about 75 percent of the total

<sup>1</sup> Compiled from data reported in Commercial Vegetables and published by D. M. Shuffett, *The Demand and Price Structure for Selected Vegetables*, U. S. Dept. of Agr. Tech. Bul. 1105, 1954, p. 37.

crop, the third-quarter price may be most applicable; however, this analysis should perhaps be concerned with the late-crop unharvested production. The supply analysis gives production as a function of last year's price, the prices paid index and trend, with the analysis in first differences of logarithms. If production is related to last year's price, it is necessary to consider the effect of yield on production. Shuffett found that approximately 60 percent of the total year-to-year variation in production was due to changes in acreage and 40 percent was due to changes in yields.

Although I have reservations as to the formulation of the supply function, the section of this paper on the dynamics of this model is of particular interest. The time required for a full cycle to approach a given percent of the deviation from equilibrium is clearly a function of the relative elasticities of the two functions of supply and demand, other things constant. In this case, 90 percent of the deviation from equilibrium is recovered in about 7 years.

The attempt to get at the regional response is commendable. The early onion crop is related to last year's farm price in the region, to last year's farm price of Texas carrots, and per capita stocks. The introduction of the competing crop of carrots is significant, but, although I have not had a chance to go into the statistics in detail to check to see if there is a definite time trend in the acreage of these two crops, the results seem encouraging.

#### DISCUSSION: ESTIMATION OF ECONOMIC RELATIONSHIPS

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The papers by Nerlove, and Suits and Koizuma, are most welcome contributions to our econometric knowledge. Supply functions have been very much neglected in econometric research. It is now only to be wished that some competent econometricians take up the study of cost functions. The paper by Ladd is a very important contribution to the solution of some vexing problems of econometric technique. It also demonstrates the value of large-scale digital computers for econometrics. A reader of Morgenstern's *Accuracy of Economic Observations* may wonder if the extent of the errors of observations in Ladd's model is not too small. The problem of multicollinearity, which appears frequently in empirical econometric work, has also been neglected.

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## MINIMUM WAGES AND OTHER LABOR STANDARDS CONSIDERED IN RELATION TO ECONOMIC GROWTH IN UNDERDEVELOPED COUNTRIES\*

Chairman: Karl Brandt, Stanford University

### MINIMUM LABOR STANDARDS IN FACTORY EMPLOYMENT IN UNDERDEVELOPED AREAS

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IF WE recognize the fact, as most labor economists are now prepared to do, that marginal productivity is not a precise or even reasonably accurate determiner of the actual earnings of any given group of workers at a given time and place, then it seems apparent that low unit labor costs may be secured either by hiring workers whose productivity is low but whose earnings are even lower or by hiring workers whose productivity is high but whose earnings are not quite so high. In other words, low unit labor costs may result from industrial operations that pitch both productivity and earnings at either a low or a high level. The low-level type is more commonly met with in underdeveloped areas and the high-level type in industrialized regions.

In terms of social, political and cultural considerations, there is an obvious preference for operating on higher rather than lower levels of productivity and earnings per worker; but is this also necessarily true from a realistic economic standpoint? Can an underdeveloped country, in its vital need to sell its exports in competitive world markets and to prevent unemployment and underemployment, afford to discard or even to weaken its traditional low-level approach to low unit labor costs in favor of the high-level alternative? More specifically, is it not deliberately handicapping itself by adopting minimum labor standards that will blunt the effectiveness of one of its supposed assets, a plentiful supply of cheap labor?

In searching for an answer to this question, numerous lines of analysis suggest themselves and ramify into widespread fields involving most of the social sciences and some of the natural sciences. Furthermore, it is reasonably clear by this time that any arguments against improved working conditions and rising standards of living for the great masses of the world's underprivileged workers may well have become both academic

\* Joint session of the American Farm Economic Association and the American Economic Association.

and irrelevant. The significant practical question at the moment is not whether there should be such improvements, but rather how fast they should come, how far they should go, and who should get credit for them.

World forces have reached the point where the workers of underdeveloped areas, whether in Asia, Africa, South America, or elsewhere, will no longer be denied; and these groundswell forces are further strengthened by the desperate rivalries between the two great world blocs. The Iron Curtain countries, spearheaded by the World Federation of Trade Unions, and the anti-Communist nations, represented by the International Confederation of Free Trade Unions, are waging a vital struggle for the adherence of underdeveloped area workers in which ideological arguments and promises must be followed by concrete economic improvements, many of which will have to be codified and written into law. This, of course, is simply another way of saying that minimum labor standards are wellnigh certain to expand both in coverage and in requirements.

But granted that this be true, it still leaves unanswered numerous questions relating to the economic soundness and desirability of these rising minimum labor standards in underdeveloped countries, with special reference to the effects upon the economic growth of such areas. It is this economic aspect of the matter with which we are to occupy ourselves here.

In undertaking such an analysis, it is necessary to spend some time in setting the boundaries of our discussion, in outlining what we are concerned with and what we are not concerned with, in restating certain basic but often forgotten concepts, and in clearing away certain unrealistic misunderstandings and assumptions.

As for our boundaries, it is essential to keep in mind that we are dealing with factory employment only. This term might be stretched, upon occasion, to include certain types of nonfactory industrial operations such as transportation, mining or agricultural processing; but it definitely excludes the two great problem fields of agriculture and household industry. Thus our task is both narrowed and simplified; for industrial operations lend themselves more readily to the imposition of minimum standards, and present a record of substantial experience that goes far beyond anything attempted in the face of the greater obstacles and complications of agricultural and household labor.

Furthermore, in the case of most underdeveloped countries, the problems to be faced and the experience that has been gained are strongly focussed upon the Conventions and Recommendations of the International Labour Organization. For all practical purposes, and with few important exceptions, the enactment of significant minimum labor standards in industrially backward countries means the ratification and implemen-

tation of I.L.O. Conventions, which dominate the field to such an extent that it is not only justifiable but unavoidable to use them as the basis for analysis. This again gives the subject a special character, and involves certain earmarks that it is essential to understand.

The Conventions of the I.L.O., of which slightly more than one hundred have been adopted since the first meeting of the Organization in 1919, are not themselves pieces of legislation, but rather legislation-suggesting enactments. They have no force or application in any country unless and until the regularly constituted legislative authority of that country embodies the provisions of the Conventions into the form of its own regular national legislation. Such a national law, putting into effect the provisions of any given Convention, is known as a ratification; and so far there have been some 1,500 of these ratifications. Thus each Convention, on the average, has led to only fifteen pieces of corresponding legislation in as many countries.

Each Convention, too, is the attenuated result of years, and sometimes decades, of slow and halting progress through the tortuous channels of I.L.O. procedures. After repeated investigations, scrutinies, counter proposals, amendments, and discussions in the Secretariat, in the Governing Body, and in committees, all on a tripartite basis, each Convention, if adopted by the annual Conference, must win the votes of a majority of the fifty percent of government delegates in addition to the normal support of the twenty-five percent of labor delegates and occasional defections from the ranks of the twenty-five percent of employer delegates.

Still later, if and when the terms of a Convention are embodied in the national legislation of some given underdeveloped country, there will be countless problems of information, education, interpretation and enforcement. Ignorance, illiteracy, habit, or lack of organization and bargaining power on the part of many workers may join with the indifference or hostility of some employers and the apathy, incompetence, or corruption of certain officials in order to open up a yawning chasm between the requirements of the legislation as existing on paper and the actual conditions prevailing in some parts of the covered industries.

This background brings out clearly a fact of the utmost significance, namely, that for the most part the actual minimum labor legislation in underdeveloped countries calls for relatively low, slowly evolved standards that have undergone repeated prunings and whittings, until they finally appealed to large numbers of critical and sophisticated government delegates as being practicable and realistic even in the face of intense national rivalries. Further, these comparatively low standards are being gradually applied and often imperfectly enforced, with generous opportunity, both official and unofficial, for special consideration in dealing

with cases involving unusual circumstances or exceptional hardship. And finally, it must be noted that these same much reduced and gently applied legal minima are concerned overwhelmingly with working conditions, rather than with wages, so that their impact upon costs is oblique and muffled, rather than direct and massive. In point of fact, in some instances in which working and living conditions, in terms of diet, clothing, housing, and rest, are so bad as to undermine bodily energy, the imposition of better standards may well result in a substantial improvement in simple physical efficiency, which in turn may have the net effect of lowering labor costs, rather than of raising them.

Of the hundred-odd I.L.O. Conventions, only three are concerned with the minimum wage as such. Two of these provide merely for setting up minimum wage-fixing machinery, one in industry and one in agriculture; while the third represents an experimental attempt to fix a minimum wage for seamen which today, after nearly ten years, has not yet been able to meet its own terms for going into effect. All of the other Conventions deal with minimum labor standards, as distinct from minimum wages, under the major headings of hours of work, social insurance, holidays with pay, weekly rest, minimum age for workers, night work for women and young persons, workmen's compensation and the prevention of accidents, maternity protection, freedom of association and the right to organize, the outlawing of forced labor, and methods of recruiting, contracts of employment, and penal sanctions for indigenous workers.

There are also, it is true, certain recommendations and resolutions, particularly those of a regional character such as several resolutions of the American states members of the I.L.O., which do pertain to minimum wages; but these are purely advisory in character, and carry no responsibility for performance. In general, the minimum wage laws in Latin American countries, which these resolutions may have encouraged, tend to be both rudimentary and poorly enforced.

Thus it appears that the actual minimum labor standards in underdeveloped countries differ widely from the sharp and sudden impositions of heavy direct increases in labor costs that are unrealistically assumed and envisaged in certain academic discussions of this subject. Of course it is true, not to say obvious, that major jumps in labor standards and costs, suddenly imposed and rigorously enforced, would have certain unsettling and detrimental effects, at least in the short run. But it is equally true that such considerations are largely irrelevant, for concrete illustrations of them in the history of minimum labor standard legislation represent the minor and infrequent exception rather than the rule. The great body of experience on this score, both in underdeveloped and in mature economies, leaves scant room for doubt.

By contrast, a study of the incidence of the realistic, I.L.O.-engendered type of legislation will serve to indicate not only that the impacts of the new standards are moderate and manageable, on the whole, but that they differ widely from group to group, from industry to industry, from place to place, from time to time, and even from one employer to another within the same industry and locality. No single stereotyped or unvarying reaction is to be found.

Let us take, for example, new legislation in some given underdeveloped country that calls for a weekly day of rest, or minimum requirements for workmen's compensation, or a maximum work-week. In all probability, even in the more backward segments of such an economy, there will be some workers who already have a weekly rest-day, whose workmen's compensation provisions equal or exceed the new standards, and whose basic work-week is not above the new maximum. Clearly these workers and their employers will be unaffected by the new legislation, except for the indirect advantage arising from the fact that the differential between themselves and their lower-standard competitors will be narrowed or erased. On the other hand, there will be an unmistakable gain for those employees whose conditions will have to be raised up to the new minimum level, and an obvious loss for those subnormal or handicapped workers (in practice usually a very small minority, if any) whose employers will refuse to hire them under the new standards, and who will consequently become unemployed.

It is in dealing with the impacts upon employers, however, that the widest variations are likely to be encountered. In terms of the working conditions in their establishments, individual employers will fall into three major groups: the best or most efficient ones, who have already voluntarily offered conditions better than the new minima, and who consequently are not affected; the average or middle-group employers, whose conditions are not far away from the new requirements, which they can therefore meet through minor or moderate adjustments that can be "taken in stride" without significant cost increases; and the poorest or least efficient entrepreneurs, whose standards are well below the new levels, and who will have to make major improvements. The last group clearly presents the real problems.

But even here there are distinctions to be drawn between individual employers, with particular reference to the question as to why their working conditions are so bad. It is because they are unscrupulous, and will not do better, or inefficient, and cannot do better? If they are unscrupulous, in the sense of exploiting workers with little bargaining power by paying them less than their productivity, however roughly measured, or less than they could and would pay in a normally competitive labor

market and some of their competitors are paying, they will face no real difficulties in meeting the new standards with comparative ease. The reasons for their poor working conditions have been in themselves, not in their employees or their plants. If, on the other hand, their operations are so inefficient that they cannot do better, then we face the question of whether the inefficiency lies in the workers or in the managements.

The proportion of workers whose productivity is so low that they cannot meet the new minimum outlays will vary from plant to plant and will fall into three main categories. First will be those whose inefficiency is due to purely physical factors such as undernourishment or inadequate housing and clothing, and for whom the very improvements in working conditions themselves will bring increased energy and health, and enable them to come up to the new requirements. Such cases are by no means uncommon in backward areas. Second will be those suffering from minor incapacities that should yield readily to quick and easy medical treatment or to brief periods of retraining or rehabilitation. There will be both informational and financial problems in connection with such persons, but they should prove to be insurmountable in fewer and fewer cases. Finally, there will be some who are so low in the scale of mental or physical capacity that they are quite incapable of meeting the new standards, and so will perforce lose their jobs. These will be added to the other casualties of industrial progress, and will swell the ranks of the unemployed, presenting problems and challenges in various fields.

But there are also mitigating factors. Past experience has shown repeatedly that the workers actually displaced under such circumstances make up a very small proportion of the whole; and sometimes even these displacements represent social gains rather than losses. Such instances include children and young persons who may again have a chance to resume educational opportunities, no matter how restricted, or who can work for parents or relatives; married women who may be badly needed at home; and aged, crippled or diseased persons who present definite health and safety problems and who need and deserve special care in order to protect society as well as themselves and their fellow workers.

The inefficiency underlying unusually poor working conditions, however, may be due to management rather than to labor. If so, the inefficient employers will fall naturally into two major groups: those who haven't taken the trouble to improve and those who have been unable to improve. Under the first heading will be those who are lazy, careless, unambitious, or tradition-bound, who have been substituting low labor standards for business energy and initiative, and who are quite capable of better performance in important business qualities when pressed. The new legisla-

tion will constitute such pressure, and they can and will come up to the required minimum levels without any serious upsets except in their own methods of doing business.

The second group, composed of those employers whose abilities are so low or whose positions are so exceptional that they must subsidize themselves at the expense of their employees, is made up of the "square pegs in round holes" who simply cannot do any better, and who will actually be driven out of business if and when the new regulations are strictly enforced. For the most part, these are the misfits of the business world—men who are obviously not equal to the responsibilities they are assuming, and who must offset their own inadequacies through impositions upon others. In general, both industry and society are better off without them, and even they themselves stand to gain by being forced into some means of livelihood for which they are better adapted.

Experience in the more mature industrialized societies indicates clearly that instances of this sort, where firms are literally driven out of business by minimum labor standards, are surprisingly small in number. Practically always other complicating factors have already put these businesses on a precarious basis. The lost production of such firms is normally picked up by more successful and profitable competitors. There seems to be no reason to suppose that the basic aspects of this experience will not be repeated, with appropriate variations, in underdeveloped as well as mature economies.

There remains the case of the "lame-duck industry," where an entire industry is functioning on a subnormal basis analogous to that of the business man just described, and where the enforcement of higher minimum labor standards might endanger a substantial proportion of the whole field of operations. This type of production, where it exists, presents a problem strikingly similar to that of tariff protection. Obviously such an industry is not well adapted to the area in which it exists, since it cannot meet the normal working conditions of ordinary industry, and consequently must offset its poor adaptation and resultant high costs through some type of subsidy. This subsidy may take the form of tariff protection, or direct payments from the public treasury, or, as in this instance, of low-standard working conditions. In any case it is a question of public policy as to whether or not the subsidy is justified, for military or political or other reasons; and if so whether it should be paid by consumers through higher prices, by taxpayers through heavier taxes, or by workers through lower earnings, direct or indirect.

In addition to this summary analysis of the varying effects of minimum labor standards upon different groups of workers and employers, there

are certain other pertinent conclusions that have emerged from what has now become a long-run period of investigation and experience in the more heavily industrialized societies.

For one thing, the effects of minimum labor legislation upon any given industry are very seldom strategic or determining. Although the effects may not be insignificant, they are extremely difficult to disentangle from many other powerful and influential factors. In general, therefore, once the matter has passed from the stage of discussion and dire prediction to that of action, most industries have been able to adjust themselves to the new requirements with relatively little real difficulty. For another thing, it is clear that the amount of unemployment directly and specifically traceable to minimum labor standards alone is usually proportionately small, frequently negligible, and often transitional. Loosely defined unemployment of this type, however, is occasionally intertwined with racial, religious, or national prejudices against minority groups; and here it may become serious qualitatively if not quantitatively.

Further, it is significant that minima seldom tend to become maxima, but that they serve rather to generate upward pressures in order to seek to maintain customary differentials; that low-standard labor is by no means synonymous with low-cost labor, and that in many instances the higher standards themselves actually lead to greater labor efficiency and thus to lower labor costs, rather than to higher ones; that where costs are increased they may be offset or swallowed up, wholly or partly, in numerous ways, including greater inducements to management to discover or to apply cost-reduction factors; that the amazing developments of modern technology, telescoped in time in underdeveloped areas, will bring about enormous increases in productivity which should greatly facilitate the attainment of higher minimum labor standards; and that these standards are important in connection with purchasing power as well as with productivity and costs.

In conclusion, it would seem to follow that where concern is focussed upon realistic and moderate minimum standards of the I.L.O. type for factory workers alone (as has been the case, it must be emphasized, throughout this discussion), the growth of underdeveloped countries is rather more likely to be hampered by legislation which is "too little and too low" than by that which is "too much and too high," economically as well as politically, socially, and ideologically. For better or worse, however, agricultural labor and household industries involve other considerations and troublesome problems that lie well beyond the scope of this analysis.

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MINIMUM WAGES AND OTHER LABOR STANDARDS IN SMALL-SCALE AND COTTAGE INDUSTRIES CONSIDERED IN RELATION TO ECONOMIC GROWTH IN UNDERDEVELOPED COUNTRIES

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I

**I**N THE last few years, there has been increasing attention paid to the role of small-scale and cottage industries in programs for the economic development of underdeveloped countries. Much of this attention has, of course, been focussed on the fundamental question of the degree of emphasis to be given small industries in development plans covering agriculture, industry and social overhead. A great deal of consideration has also been given to the technical aspects of small industry: the possibilities for introducing modern technological improvements into traditional methods of production, improving marketing and distribution facilities, and the like. To the extent that labor's place in small industry has been examined, this has been largely in terms of the opportunities that such enterprises offer for supplementing the income of agricultural workers. There has also been some attention given to the educational benefits to be derived, through increased skills in the use of mechanized and semi-mechanized equipment, and through training in managerial and administrative techniques. Relatively little has been noted, however, about the role of minimum wages or other labor standards, beyond the bare recording of the extremely low wage rates that prevail, and the tremendous barriers that exist to hamper any significant rise in wages in the immediate future.

It is completely understandable that the matter of wage rates in small industries should be of minor interest in most underdeveloped countries at this time. Where capital is scarce and the labor supply overabundant, where the ultimate goal of current development programs is to achieve a subsistence level for the mass of the population, questions of minimum wages, shorter working hours, sick benefits or workmen's compensation assume a fairly low priority in the calculations of government planners, university economists and, quite probably, the population at large. The urgent problems revolve around the factors noted above: production, marketing and distribution, the factors appearing to have the most immediate relevance to the key question: what contribution can small industries make to economic development?

Some assessment of the relative significance of small-scale units in industrialization is fundamental to any meaningful consideration of labor standards in those industries. Before turning to that, however, it would

be wise to define just what is meant by the terms small-scale and cottage industries as used in this paper.

## II

There is a certain amount of haziness in the use of these terms and no general agreement on what constitutes small-scale as opposed to large-scale industry, what differences if any exist between small-scale and cottage industries, and the relation of both of these to handicrafts. For the purposes of this paper, the terminology employed will be that adopted by a working party of the Economic Commission for Asia and the Far East a few years ago.<sup>1</sup> Thus, a cottage industry is defined as one carried on wholly or primarily with the help of the members of the family, whether as a whole or a part-time occupation. A small-scale industry is one that is operated mainly by hired labor, usually not exceeding fifty workers in any establishment or unit not using any motive power, or twenty workers in any establishment using such power. A handicraft industry is a cottage or a small-scale industry, the products of which are artistic in character and require skill and craftsmanship in their manufacture.

To the ECAFE definition might be added the point that, especially in Asian countries, the small-scale industries are generally those financed by local capital, employing local raw materials as well as locally recruited labor, and in most instances producing consumer goods for the local market, in contrast to the cottage industries, which more often produce handicrafts for the export market or the tourist trade.

Given these definitions, it is clear that the whole question of labor standards becomes more or less irrelevant for cottage industries, which are family enterprises and hence almost impossible to regulate. Therefore, our concern here will be with small-scale industries. However, it should be noted that because of this confusion of terms, what is listed as a cottage industry in one country is many times called small-scale industry in others. Indeed, there is frequently a variation in the terminology used by official agencies within a single country. In Burma, for example, the enterprises that come under the government's extensive cottage industry program are for the most part identical with those defined here as small-scale industry. In Japan, the units listed under the general heading of small-scale industry often employ more than two hundred workers.

## III

This is not the place to go deeply into the relative merits of large-scale versus small-scale industries in the development of underdeveloped

<sup>1</sup> International Labour Organization, Expanded Programme of Technical Assistance, *Survey of Handicrafts and Small-scale Industries in Ceylon*, Geneva, 1952, p. 54.

areas. However, there are some points that should be made to illuminate the background against which we can examine the role of labor standards in small enterprises.

1. Small-scale units predominate at present throughout Latin America, the Middle East and Asia, and they may well continue to do so for some time to come. In Latin America, the average number of workers per industrial undertaking is 13 in Argentina, 10 in Brazil, 29 in Chile, 15 in Colombia, 20 in Mexico and 9 in Uruguay. Much the same picture holds true for Asia and the Middle East. In the Philippines, for example, of some 610,000 persons employed in manufacturing industries in 1939, at least 360,000 worked in small-scale or cottage industries. In prewar Indonesia, of 2,800,000 workers engaged in manufacture, 2,500,000 worked in small-scale enterprises.<sup>2</sup>

In Japan, the most highly industrialized country in Asia, in 1951, 99.49% of all industrial enterprises employed fewer than 200 workers, and more than 92% of all units employed less than 30 workers.<sup>3</sup> In the prewar era, when Japanese textiles played such an important role in the world market, three-quarters of Japan's textile workers were employed in factories with less than 50 workers, and more than one-half of her textile workers operated in units employing fourteen or fewer workers.<sup>4</sup> The concomitant existence of large and small-scale units has gone on for several decades in Japan, and despite the expansion in large-scale enterprises, the relative position of the two types of establishment has not shifted appreciably since the early years of this century.

2. There is good reason for assuming that the predominance of small industries in many of the underdeveloped countries will persist for an indefinite period of time. For one thing, there is the example suggested by the pattern of industrialization in many of the economically advanced Western countries. It would be a mistake to assume that small-scale industries are characteristic only of underdeveloped areas and belong to a stage of evolution that must necessarily be outgrown if a higher standard of living is to be achieved. There are numerous instances of relatively prosperous countries, with economies that are generally reckoned as highly developed, in which small-scale and large-scale enterprises operate

<sup>2</sup> United Nations, Department of Social Affairs, *Preliminary Report on the World Social Situation, with Special Reference to Standards of Living*, New York, 1952, p. 104.

<sup>3</sup> United Nations, Economic Commission for Asia and the Far East, Committee on Industry and Trade, *Report of the Study Group of Small-scale Industry Experts on their Visit to Japan*, New York, 1955, p. 21.

<sup>4</sup> Joseph E. Stepanek and Charles H. Prier, *Rural Industries in Underdeveloped Areas*, University of Denver, Denver, 1950.

side by side. The classic example of course is Switzerland, where the watch industry has been characterized as almost entirely a highly developed cottage industry.

In prewar Germany, 87% of all industrial establishments employed fewer than 5 persons. In 1925, 23.8% of Germany's total labor force, excluding mining and construction, were employed in enterprises of 5 or fewer workers. Enterprises with from 6 to 50 workers accounted for another 21.8% of the labor force, making a total of 45.6% of all employed workers in enterprises with 50 or fewer workers.<sup>5</sup>

In France, in 1921, 466,000 out of the 550,000 industrial establishments employed 5 or fewer workers,<sup>6</sup> and the predominance of small units in the French economy has not altered appreciably in recent years. Although the cases cited, and perhaps France especially, stand in need of some basic economic changes, the standard of living enjoyed in those countries compares most favorably with that in the nations currently classified as underdeveloped. Where the French and German economies have made the most of their industrial pattern is in the development of good marketing and distribution systems. In any case, though, it would seem that small-scale units need not automatically disappear as economic growth takes place.

3. A more immediate reason for counting on the continuation of small-scale enterprises in the less developed areas is the extreme scarcity of the capital resources necessary to finance large-scale enterprises. In almost every instance, the capital available is insufficient to finance both the essential heavy industries and the minimal amount of social overhead needed to get development under way, let alone the financing of large-scale plants for producing some of the consumer goods that are the main contributions of the smaller industries.

In the larger underdeveloped countries, the lack of adequate transportation facilities often puts the small local industries at a competitive advantage vis-a-vis the larger urban plants, both in cheaper access to raw materials and in far lower transportation costs in reaching markets. It should also be remembered that the size of units in modern industrialized countries is actually dependent in many cases on the size of the market. In underdeveloped areas, this involves both the question of effective demand and the problem just noted of the accessibility of markets. In the view of several authorities on industrialization of underdeveloped areas, small-scale industries have the advantage of being more flexible in adjustment

<sup>5</sup> Henry G. Aubrey, *Small Industry in Economic Development*, 1951, Appendix B, p. 4.  
<sup>6</sup> *Ibid.*

to changes in demand.<sup>7</sup> These factors, plus the heavy cost of urbanization and the scarcity of the skills needed for heavy industry, emphasize the likelihood of the persistence of small units.

4. Finally, there is the crucial difference in the situation faced by the West at the beginning of the industrial revolution and that faced by most underdeveloped areas today: the West started off with a much more advanced base of economic organization. There was a market system, well developed monetary and banking organizations, and a good deal of preindustrial manufacturing in large workshops. These conditions are not typical for most underdeveloped areas of the twentieth century. Tremendous amounts of capital will be needed by these countries just to reach the level of economic interchange that characterized the West at the outset of the industrial revolution. At the same time there are in many of the underdeveloped countries much greater social and cultural barriers to progress and a weaker trend toward innovation than was the case in the West.

Given this general framework, and the extreme scarcity of capital, it is clear that small-scale units will continue to play a major role in the less developed countries. In some instances, they will play a largely transitional role, as they did in parts of the West; in many others, they will continue to dominate the economy for many years to come.

#### IV

Thus, the question of labor standards in small industries is not a minor problem for these countries. How successfully such standards can be applied to smaller enterprises in the underdeveloped areas can be inferred partly from an examination of the situation in the West and its historical development. But the problem, especially in Asia, is far more complicated than it was in the West.

If one sets as one of the objectives of economic development a visible raising of the standard of living of the mass of the population, there is no reason to question the direct benefits to be derived from the enforcement of minimum wage rates and improved working conditions. Economic and social advancement along these lines must be considered an integral part of the whole process of economic growth. The problem revolves around determining the stage in the development process at which such measures can be taken without producing such violent dislocations in the economy that the over-all objectives of development are defeated. There is also the very practical question of determining the

<sup>7</sup> See esp. United Nations, *Economic Development of Under-developed Countries: Integrated Economic Development*, New York, 1952; Stepanek and Prien, *op. cit.*

stage of development at which it is possible to enforce such measures with any reasonable degree of success.

The situation prevailing in most underdeveloped areas with respect to minimum wage rates could be summed up as follows: although there has been a great increase in the introduction of minimum wage legislation in the past decade, small-scale industries, more often than not, are not covered by the law. Where regulations do, on paper, extend down to the smaller units, the likelihood of their being implemented and the possibility of their being enforced is minimal.

In the first place, the prevalence of small undertakings is an obstacle to the development of adequate inspection services, especially in countries where the lack of trained personnel is very keenly felt in government services. Secondly, although there has been a marked growth in trade unionism in these areas during the past decade, small establishments are not well adapted to such channels of operation. For one thing, the employed workers are few in number and separated from their colleagues in other plants, and thus have less opportunity to crystallize individual grievances into a clearly formulated demand for a specific change. For another thing, their relationship to their employer is generally of a much more personal character.

As far as other labor standards go, the situation in small-scale industries is much the same as the minimum wage situation just summarized. Legislation aimed at child labor, at unduly long working days and unhealthy working conditions is difficult to enforce, and in most countries social security laws do not apply to a majority of the smaller units.

Under these circumstances, what is the wage picture in small industry? To the extent that data are available—and in many small industries, few if any records are kept—it is obvious that the prevailing wage rates in most small units are consistently below those in the larger enterprises. Conditions of labor are most depressed in those industries where the survival of the small-scale units is threatened by directly competing large-scale enterprise, and the small units are therefore either undergoing a period of transition or are clearly on their way out. In certain lines to which small-scale units are particularly well suited, the wage level tends to compare more favorably with that prevailing in larger enterprises. For example, in Ceylon in the textile industry, the government is encouraging a shift from small-scale to large-scale units in gray goods production because, on a comparative basis, the smaller units are far less efficient. However, at the same time, small-scale units are being fostered by the government for the production of the traditional, brightly colored and intricately woven patterned silks for which demand remains quite high.\*

\* Survey of Handicrafts and Small-scale Industries in Ceylon, Geneva, 1952.

Naturally, under these circumstances, wages in the small-scale gray goods plants are falling rapidly, while in the plants producing the traditional prints, for which no efficient large-scale process has yet been devised, wages remain relatively high.

Although wages tend to be lower in the small-scale enterprises, when the small industry is located in a rural community it does not necessarily follow that the lower wages, relative to those paid in larger, urban enterprises, mean a more depressed living standard for the worker in small industry. In such cases, the effect of the lower money wages is frequently offset by the rather special social patterns that are still the dominant feature of village life in many of the less advanced countries. In Asia and much of the Middle East, the concept of the extended family unit still prevails in rural communities, and many of the welfare services, provided for in urban areas by social legislation, are here covered on this traditional, private basis. It may well be, as it often is in India and Pakistan for example, merely a sharing of misery. But it is still a very real force, and in more richly endowed countries like Ceylon and Indonesia it can make a real contribution toward alleviating economic distress. This family tie, and the resources supplied in its name, is apparently loosened considerably with migration to the cities. Therefore, the greater disparity between urban and rural wages in many underdeveloped countries is to a certain extent more apparent than real.

The problems of setting minimum wage levels and not interfering with economic growth are problems that vary from country to country and essentially have to be dealt with on an institutional basis. In Puerto Rico, the procedure in use for some years has been to establish a board for each industry to set the minimum wage rates for that industry. This technique has been fairly successful in preventing wages in small industries from falling below the margin. While it is generally recognized that Puerto Rico enjoys a unique status among underdeveloped areas, there are nevertheless certain countries in Latin America where the level of development is such that an approach might be made along the lines developed in Puerto Rico. In South and Southeast Asia, on the other hand, the core of the problem lies in the numerous obstacles that stand in the way of getting any appreciable amount of industrial development started. What, then, would be the impact on economic growth of minimum wage standards that would probably have their harshest effects on the smaller units? The Puerto Rican procedure, for all that it is relatively simple and inexpensive, is still beyond the means of many Asian countries where the choice lies, and is going to lie for some time, between employment at very low wages or no employment at all.

Where small-scale industries provide a supplementary source of income, however meager, and especially in agricultural communities, their

very presence appears to be a step forward toward development which, in most cases, perhaps should not be unduly tampered with for the present. Even in large cities like Bombay and Calcutta, where small industries flourish but pay wages and impose working conditions far below the standard of the larger enterprises, it is questionable if an effort to raise wages in these plants would contribute to the general welfare, failing alternative employment opportunities for their labor force. Where large profits are being earned principally by the overexploitation of labor (for whatever institutional reasons), the situation is unfavorable for the reinvestment of those high profits in, for example, more efficient machines. Therefore, if an approach is to be made toward improving the working conditions of labor in small enterprises, perhaps the logical place to begin would be in the urban areas and in those establishments where wage rates are below the marginal level required to supply the market.

In general, it could be said that once a minimum stage in development has been reached in the total economy through increased agricultural production, through the provision of the most essential of the many features that make up social overhead, and through the growth of some basic industry as well as advances in light industry, then it would seem that the time had arrived when labor legislation might effectively be extended to cover small-scale enterprises.

MINIMUM WAGES AND OTHER LABOR STANDARDS  
IN AGRICULTURE CONSIDERED IN RELATION TO  
ECONOMIC GROWTH IN UNDERDEVELOPED  
COUNTRIES\*

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*Introduction*

THE CONCEPT of "labor standards" had its origin in the social welfare movements of the 19th century that followed in the wake of the industrial development of the Western World. The regulation of working conditions in industrial establishments developed slowly in the 19th century in Europe and North America. Everywhere the development of labor standards governing the conditions of work lagged behind the advance of the industrial system. The prevalent attitude against state intervention in any form was particularly strong with regard to labor legislation and reform. In England, for example, all attempts to regulate wages through state action put forth during the 19th century were defeated.<sup>1</sup>

Toward the end of the last century, almost 150 years after the invention of the steam engine, the inequities of the conditions of work under the factory system were beginning to get widespread attention. The rise of the trade union movement, investigations by various Western governments, the Encyclical of Pope Leo XIII, and the writings of many authors were contributing to a growing awareness of the need for improving the wages and working conditions of industrial workers. Besides the question of wages, the improvement of working conditions focused on such matters as reduction of excessively long hours of work, observance of minimum standards of safety and health in places of employment, and regulation of the employment conditions of children, young persons and women. From that time until the present, the improvement of standards of labor has been consciously and more or less continually sought in most of the industrialized nations of the world through legislation and through the encouragement and protection of collective bargaining. The greatest advances in the widespread acceptance of progressively improving labor standards and in the enactment of broad types of social and labor legislation have been made largely in the decades since World War I. In western Europe and North America this was also the period when industrializa-

\* Acknowledgment is made to Janet Stanton, AMS, for assistance in gathering information and to the following agencies for providing much of the factual information: the International Labor Office, the Division of Foreign Labor Conditions, U. S. Department of Labor, and the Foreign Agricultural Service, U.S.D.A.

<sup>1</sup> E. M. Burns, *Wages and the State*, London: P. S. King, 1926, Chapter I.

tion, productive efficiency and the growth of the free trade-union movement reached their highest levels of development.

Despite some notable exceptions, the role and application of labor standards have been quite limited in agriculture, even among the economically developed nations. The concept of labor standards in its job relations context and its definitely industrial origin has not proven readily transplantable to agriculture. The predominance of small-scale enterprises and a labor force in which wage workers are only a relatively small fraction in both developed and underdeveloped countries present a very different set of conditions from those in industry. However, there is a wide diversity of agricultural conditions among and within countries, ranging from primitive subsistence agriculture to highly developed large-scale plantations. These differing conditions underlie in part the differing experiences of various countries in the enactment and application of minimum wage and other labor standards to agriculture.

#### *Review of Development of Minimum Wage and Other Labor Standards in Agriculture*

The fixing of wage rates for agricultural labor by direct individual negotiation between the employer and the worker is still the predominant system over large parts of the world.<sup>2</sup> Trade union organization and collective bargaining in agriculture are of limited significance in most areas of the world. The greatest progress in collective bargaining in agriculture has been made in a number of European countries where the level of wages, hours of work, vacations with pay, and other conditions of work in agriculture have been importantly influenced by the activities of agricultural trade unions. This is especially the case in the United Kingdom, the Netherlands, and the Scandinavian countries.<sup>3</sup> In the underdeveloped areas of the world, collective bargaining by agricultural workers is virtually absent except for the few instances of labor organization among plantation workers.

Minimum wage laws covering industrial workers, common today in nearly every nation with a substantial nonfarm labor force, originated in Australia and New Zealand. In Victoria, the Factories and Shops Act of 1896 fixed a state-wide minimum wage. In 1898, New Zealand amended the Industrial Conciliation and Arbitration Act of 1894 enabling the Court of Arbitration to prescribe minimum rates of wages.<sup>4</sup> The State of Queensland in Australia established a statutory minimum wage for

<sup>2</sup> International Labour Conference, 1950, *Minimum Wage Fixing Machinery in Agriculture*, Report VII (1), I.L.O., Geneva, 1949.

<sup>3</sup> International Labour Conference, 1950, *Labour Problems in Agriculture, General Report*, Report VI, I.L.O., Geneva, 1950, p. 38.

<sup>4</sup> E. M. Burns, *Op. cit.*, pp. 11, 39.

certain lower-graded workers in the Factories and Shops Act of 1900.<sup>5</sup> These early laws were modified and other Australian States adopted some type of minimum wage legislation during the next few years. Several of these laws were broad enough to cover farm workers and under their provisions minimum wages were set for pastoral workers in a number of Australian States in 1907. Minimum wage awards for sheepshearers, wool pressers, fruit harvesters and certain other agricultural workers have been granted from time to time by the Australian Federal Court.<sup>6</sup> The early wage regulations in Australia applied to only a few organized groups of agricultural workers and doubtless were motivated by a desire to assure the supply of these skilled and experienced workers and to improve their working conditions.

Although industrial wages had been regulated in Great Britain since 1909, the first minimum wage law applying exclusively to agricultural workers was incorporated in the British Corn Production Act of 1917. This act was part of a program of government subsidies to encourage agricultural production during World War I and specified that farmers were to pay wages determined by county wage boards as a qualifying condition for receiving subsidy payments. These laws were part of the emergency World War I legislation and were designed to encourage production and minimize labor difficulties. This law lapsed with the withdrawing of subsidies in 1921; however, a new minimum wage law also using wage boards was passed in 1924 and applied to England and Wales only.<sup>7</sup> The linking of minimum farm wages to governmentally supported farm prices was also a part of the 1936 Agricultural Workers Act in New Zealand.

The earliest act regulating agricultural wages in an American nation was enacted by Uruguay in 1923, where minimum wages are fixed by statute.<sup>8</sup> More recently, specific minimum rates have been set by law in Argentina and Cuba. Changes in these rates generally are possible only through amending legislation. Wage regulation procedures utilizing existing workers' and employers' associations were enacted by Brazil in 1936 and extended to agricultural workers in 1940. Joint committees have been set up in Brazil consisting of representatives of worker and employer organizations with a chairman appointed by the Minister of Labor.<sup>9</sup> These committees make minimum wage recommendations to the Minister of Labor, who implements the application of the rates by

<sup>5</sup>*Ibid.*, p. 58.

<sup>6</sup>D. B. Copland and O. deR. Foenander, "Agricultural Wages in Australia," *International Labour Review*, June 1932, pp. 771-786.

<sup>7</sup>E. M. Burns, *Op. cit.*, pp. 89, 95-97.

<sup>8</sup>*Minimum Wage Fixing Machinery in Agriculture*, *Op. cit.*, p. 84.

<sup>9</sup>*Ibid.*, p. 63.

decree. Other American nations that have established minimum wages for agricultural workers through wage boards are Mexico (1917), Cuba (1934), Ecuador (1937), Costa Rica (1943), Argentina (1944), Nicaragua (1945), Panama (1947), and Chile (1953).<sup>10</sup>

The Minimum Wages Act of India, enacted in 1948, directed the provincial governments to fix minimum wages for agricultural workers and certain nonagricultural workers within three years following the passage of the Act, and to review these rates periodically. Rates are to be set by committees and reviewed by advisory boards appointed by the provincial governments. A central advisory board will coordinate the various decrees.<sup>11</sup>

Minimum wage legislation for agricultural workers has been enacted or related administrative measures have been taken also in Egypt, Burma and Ceylon. Regulations in Ceylon apply to workers on tea and rubber plantations.<sup>12</sup>

The first law adopted by any Asiatic nation that set statutory minimum wages with nation-wide application was enacted by the Philippines in 1951.<sup>13</sup> Both industrial and agricultural workers were covered by the act setting minimum wage rates. Retail or service enterprises with five or fewer employees and farms of 12 hectares (29.65 acres) or less, were exempt from paying minimum wages to their employees.

Other labor standards for farm workers have generally been limited to regulating hours of work and have passed over such matters as safety requirements, hazardous jobs and sanitation. The legislation dealing with length of work period either limits the length of the work day or week (usually with a summer-winter differential) or specifies minimum vacation periods.

The United Nations, through its specialized agency, the International Labour Organization, has in recent years given increasing attention to labor problems in agriculture, both from the standpoint of encouragement of labor standards and of measures to improve the levels of living of workers in agriculture through technical assistance programs of economic development. In collaboration with FAO and other specialized UN agencies the ILO is participating in activities pertaining to land reform, rural cooperatives, and vocational training in addition to its own programs of employment and manpower utilization problems. More than 70 nations are now members of the International Labour Organization

<sup>10</sup> *Minimum Wages in Latin America*, International Labour Office, Geneva, 1954.

<sup>11</sup> *Minimum Wage Fixing Machinery in Agriculture*, Op. cit., p. 72.

<sup>12</sup> Asian Regional Conference, *Problems of Wage Policy in Asian Countries*, I.L.O., Geneva, 1953, Report 1, p. 65.

<sup>13</sup> Urbana A. Zafra, *Philippine Economic Handbook*, Washington, D.C., 1955, Chapter X.

and are represented at the annual conferences of the ILO by tripartite delegations of government, employer and organized labor representatives.

In the labor standards field the International Labour Conference adopted, in 1951, a Convention on Minimum Wage Fixing Machinery in Agriculture, which requires countries ratifying the Convention to set up such wage fixing machinery and sets forth general principles to be observed in these wage fixing procedures. Eleven countries have since adopted this Convention, among them being Ceylon, Cuba, Mexico, the Philippines, and Uruguay, in addition to the ratifications by Austria, France, the Federal Republic of Germany, the Netherlands, New Zealand, and the United Kingdom. In 1952 a Convention was adopted on holidays with pay in agriculture, which sets forth general conditions under which paid vacations to agricultural laborers are to be granted by employers in countries ratifying the Convention. Eleven countries have since ratified this Convention: Austria, Belgium, Cuba, France, the Federal Republic of Germany, Israel, New Zealand, Norway, Sweden, Uruguay and Yugoslavia. This year the Conference examined a Recommendation on Vocational Training in Agriculture and final action by the ILO on this Recommendation will take place at the next year's Conference. Other recent Conventions of the ILO, although not relating exclusively to agricultural workers, are of broad, general application to all wage earners regardless of industry. These include the Conventions on Right to Organize and Collective Bargaining, Equal Pay for Equal Work to Men and Women Workers, and the Convention on Minimum Standards of Social Security.

#### *Experience with Minimum Wage and Other Labor Standards Legislation*

Discussions of the effect of minimum wage legislation in the economic literature have been almost entirely at a theoretical level and have been largely in the context of industrial labor conditions in industrially advanced nations. Most of the early writers concluded that, all other relevant economic variables remaining unchanged, fixing of a minimum wage would result in unemployment.<sup>14</sup> The assumptions of a perfect market and full employment were generally implied or expressed. Later economists have modified some of the assumptions in order to bring them closer to actual conditions.<sup>15</sup> By postulating a different shape of the marginal cost curve than is assumed in more traditional analyses, and by allowing for the income effect on consumer demand of general minimum wages, some recent writers have concluded that a minimum wage set to raise the lowest incomes would have more favorable effects on the em-

<sup>14</sup> D. Hamberg, "Minimum Wages and the Level of Employment," *The Southern Economic Journal*, January 1949, p. 321.

<sup>15</sup> Weir M. Brown, "Some Effects of a Minimum Wage Upon the Economy as a Whole," *American Economic Review*, March 1940, p. 98.

ployment levels than unfavorable, or that such laws need not necessarily result in unemployment to any significant degree.<sup>16</sup> There are, of course, other gradations of views, such as the intermediate view that there exists a zone beyond which minimum wages could not be set without producing adverse effects on employment levels and that this zone is not an absolute one but is relative to the stage of the economic cycle, the existing wage structure, the production and demand conditions in the affected industries, and many other economic variables. The challenge to the framework of the more traditional analyses has not been limited to minimum wage and related problems but has involved fundamental aspects of the theory of marginal analysis.<sup>17</sup> In focusing on a broader theory of the nature and role of labor problems in economic development, four of the leading labor economists in the United States have recently called for a reappraisal of the traditional analysis and have suggested a broader framework for a reappraisal.<sup>18</sup> Such reappraisal, they believe, would necessitate introducing into the analyses conditions that explain the industrialization process in other cultures than those of the West, and that would be able to accommodate labor problems in underdeveloped as well as in developed countries and unorganized labor as well as organized labor. They quote with approval a conclusion of Eugene Staley and another one of A. K. Cairncross.

If capital investment and material technology are pushed energetically in an underdeveloped country while little or no attention is given to deliberate promotion of appropriate social and psychological change—that is, to the more specifically human side of development—the result is likely to be either a failure of the development process to “take” and become “self-generating” or creation of a menace to the free world.<sup>19</sup>

The problem is often one of organisation quite as much as of capital creation: of training managements and men; of creating new attitudes toward industrial employment; of taking advantage of innovations that need little capital and using the resulting gains to finance investment elsewhere.<sup>20</sup>

In their own analysis Kerr and associates recognize the influence of the institutional and sociological factors in characterizing the industrialization process under different cultural settings.

Industrialisation is taking place in a wide variety of cultural environments. The process of these industrialisations—their source of capital funds and labour

<sup>16</sup> *Ibid.*, p. 107, and D. Hamberg, *Op. cit.*, p. 336.

<sup>17</sup> R. A. Lester, “Shortcomings of Marginal Analysis for Wage Employment Problems,” *American Economic Review*, March 1946.

<sup>18</sup> Clark Kerr, Frederick H. Harbison, John T. Dunlop, and Charles A. Myers, *The Labour Problem in Economic Development*, Institute of Industrial Relations, Univ. of Calif. Reprint No. 79, 1955.

<sup>19</sup> Eugene Staley, *The Future of Underdeveloped Countries*, New York: Harper & Brothers, 1954, p. 203.

<sup>20</sup> A. K. Cairncross, “The Place of Capital in Economic Progress,” *International Social Science Bulletin*, Vol. VI, 1954, p. 236.

supply, type of management and speed of transformation—likewise reveal quite different courses. The labour problems in economic development accordingly reflect these diverse patterns of industrialisations.<sup>21</sup>

Despite the rather extensive literature in this country of a theoretical nature regarding the economic effects of a minimum wage, very few empirical studies have been attempted to determine the extent to which theoretical conclusions regarding the effects on employment, unemployment, prices, profits, etc. have occurred in actuality. Apparently the only study of substantial scope made in the United States is the one carried through by the United States Department of Labor to obtain data on the effects of the increase in the minimum wage under the Fair Labor Standards Act from 40 cents to 75 cents an hour, which became effective January 25, 1950.<sup>22</sup> The studies and research undertaken in this project did not fully accomplish the objective of determining both the short-range and long-range effects of this substantial increase in the minimum wage because the outbreak of the Korean conflict in the middle of 1950 set in motion rapid changes in the economic picture that overshadowed and obscured the influence of the new minimum wage. Nevertheless, the results of the study showed in fairly clear perspective the short-range effects. The data developed in the part of this study that surveyed the effects of the higher minimum wage in five low-wage manufacturing industries where the impact was greatest resulted in the following conclusion:

Despite causing significant wage increases, the 75 cent rate appeared to have had only minor effects on such variables as employment, plant shutdowns, prices, technological change, hiring policies, and overtime work. . . .<sup>23</sup>

Discussion of the effects of minimum wage legislation has not been confined to the professional economists. As early as 1827 a British Committee on Emigration argued against state wage regulation:

It is from an entire ignorance of the universal operation of the principle of supply and demand regulating the rate of wages, that all these extravagant propositions are advanced.<sup>24</sup>

In more recent times, the debate has continued in national legislatures concerning enactment or modification of minimum wage laws. If the fight over state intervention in wage regulation has been bitter in the more advanced Western countries, it is no less so today in some of the less developed areas. The effect of the Philippine minimum wage act, for example, has been the subject of a spirited debate in the public press be-

<sup>21</sup> Kerr, et al., *Op. cit.*, p. 15.

<sup>22</sup> *Results of the Minimum-Wage Increase of 1950: Economic Effects in Selected Low-Wage Industries and Establishments*, U. S. Dept. of Labor, Aug. 1954.

<sup>23</sup> *Ibid.*, p. 13.

<sup>24</sup> E. M. Burns, *Op. cit.* p. 3, quoting from the Third Report of the Select Committee on Emigration from the United Kingdom, 1827.

tween the Secretary of Agriculture and the Secretary of Labor of that country.<sup>25</sup>

Experience with minimum wage laws affecting agricultural workers has been as varied as the nations that have adopted such legislation. Generally, those countries with literate, well organized farm workers and with high agricultural productivity have been able to set minimum wage standards that have resulted in higher average real incomes for agricultural workers. In some instances, as in Australia and New Zealand, these increases were given only to the best organized groups among the farm labor force, such as the sheep workers and dairymen. Even in these nations, however, periods of economic stress have led to a reduction of minimum wages or outright repeal of such laws. The British law of 1917 was repealed in 1921 in the postwar agricultural recession and sharp reductions in minimum wage rates in Australia occurred during the early 1930's.

Since World War II, underdeveloped countries have given increasing attention to labor legislation in their agricultural and general economic development programs. The economic impact of minimum wage legislation in the underdeveloped regions of the world may be quite different from that felt in the more advanced nations. Chronic unemployment and underemployment, low productivity of labor, scarcity of capital, and lack of technical skills, characteristic problems of most underdeveloped areas, are fundamental maladjustments. However, information on the effects of minimum wage and other labor legislation on the economic status of agricultural workers is extremely sketchy.

Although many underdeveloped countries have adopted some type of minimum wage legislation, there is frequently a wide gulf between the legislation and its effective application. One analyst appraising minimum wage legislation in Latin America, where nearly every country has some type of such legislation, observed:

Everywhere the public is aware of the problem caused by extremely low wages; everywhere legislation has been passed to improve them; everywhere the principle has been accepted. Yet the gap between what the law lays down and what is actually done to give it effect is quite considerable. . . .<sup>26</sup>

This writer lists three main reasons for the gap between law and practice: (1) defects in the statute itself, (2) the novelty of the system, (3) national circumstances that make implementation difficult. Although this appraisal was made with respect to minimum legislation in general, it probably is even more applicable to the situation in these countries with respect to implementation of wage regulation for agricultural workers.

<sup>25</sup> See articles in the *Manila Times* of Oct. 15, 16 and 17, 1954, by Salvador Araneta, Secretary of Agriculture and Natural Resources, and of Oct. 22, 23 and 24, 1954, by Eleuterio Adevoso, Secretary of Labor.

<sup>26</sup> Jorge Mendez, "Minimum Wages in Latin America," *International Labour Review*, Vol. 62, Aug. 1950.

Many other countries have enacted broad, progressive measures that have had little or no effect on agricultural wages or working conditions. The obstacles to an effective enforcement of minimum wages for agricultural workers are great. In India, for example, the time limit for fixing minimum wages in agriculture under the Act of 1948, which was to have become effective in 1951, was extended until the end of 1953. By that time, minimum wages had been fixed in the Punjab and proposals for minimum rates had been published in Bilaspur.<sup>27</sup> P. S. Narasimhan has listed the practical difficulties that have delayed the implementation of India's Minimum Wage Act as the great diversity of economic and social conditions throughout the country; the multiplicity of wage payment schemes; the absence of even the most rudimentary workers' organization; and the lack of sufficient data upon which statutory minimum wage rates can be based.<sup>28</sup> Burma had to postpone the enforcement of its minimum wage law because of political disturbances. On the other hand, the three-fold increase in plantation wage rates in Ceylon from 1939 to 1950 has been attributed largely to the successful operation of the Wage Board machinery and the activities of trade unions on the plantations.<sup>29</sup>

The Philippine minimum wage law was appraised recently in a report to the President by a special survey committee appointed to investigate the effects of the law. The report concluded:

"The over-all economic picture does not show any dislocations which can be specifically attributed to the operation of the minimum wage law,"<sup>30</sup>

". . . Agricultural production on the large farms most affected by the law has steadily increased since the effective date of the minimum wage law . . ."<sup>31</sup> and

"To summarize, your committee has found no evidence pointing to the minimum wage law as a factor discouraging investments."<sup>32</sup>

The committee report points out that there are difficulties in enforcement, especially in rural regions, but concludes the existing law should be maintained because it is socially and economically sound, it has not caused unemployment and it is capable of reasonable enforcement.<sup>33</sup> The committee, however, recommended that there should be further study of rather basic provisions of the present law. This included such questions

<sup>27</sup> *Problems of Wage Policy in Asian Countries*, Op. cit., p. 65.

<sup>28</sup> P. S. Narasimhan, "Labour Reforms in Contemporary India," *Pacific Affairs*, March 1953. The Ministry of Labour of India has since carried through extensive surveys on agricultural labor throughout India in collaboration with the state governments. The resulting reports provide a rich source of information on the agricultural labor population, employment, income, and living conditions.

<sup>29</sup> *Problems of Wage Policy in Asian Countries*, Op. cit. p. 66.

<sup>30</sup> *Report to the President of the Philippines submitted by the Survey Committee on the Minimum Wage Law*, Manila, 1955, (processed) p. 15.

<sup>31</sup> *Ibid.* p. 28.

<sup>32</sup> *Ibid.* p. 22.

<sup>33</sup> *Ibid.* pp. 41-44.

as national statutory minima (as in the present law) versus wage board determinations of the minimum varying by locality and industry, the basis of the existing differentiation between agricultural and nonagricultural workers' minimum wage, and variations over time in the minimum wage to allow for changes in the cost of living.

One recent change in the application of the Philippine minimum wage law has resulted from Section 7 of the 1955-56 Public Works Bill passed August 9, 1955. This has the effect of reclassifying workers on public works projects in rural areas from industrial workers, with a statutory minimum wage of 4 pesos per day to agricultural workers with a statutory minimum wage of 2.50 pesos per day.

Uruguay, which has a distinguished record of achievement in the field of social legislation, has set up governmental machinery to provide invalidity, old-age and unemployment insurance for farm laborers comparable to that provided for laborers in industry and commerce.

With respect to minimum wages, a recent appraisal concludes that the rates fixed have had a substantial influence on wages as a whole, and adds:

The Uruguayan system . . . has become a very popular institution. The wage councils have issued awards which in addition to fixing rates, almost invariably include thoughtful and comprehensive reports on the situation . . . and on . . . ability to pay in relation to worker needs.<sup>34</sup>

According to the Minister of Labour, the real wages of farm laborers advanced appreciably between 1943 and 1949.<sup>35</sup> In addition to minimum wage legislation, efforts to raise the standard of living of the rural population in Uruguay also include pensions and retirement benefits, the provision of land, credit and technical aid.<sup>36</sup>

#### *Labor Standards and Economic Development*

In view of the topic of this paper, it may be appropriate to conclude by examining the question: Is there any necessary relationship between minimum wage and other labor standards in agriculture to agricultural development directly and to economic development indirectly? The experience of the United States might, on the surface, suggest that a country can achieve a very high degree of agricultural and general economic development without a program in agriculture of minimum wages and other types of labor standards traceable to legislation or to collective bargaining. This answer is not necessarily conclusive or applicable to other countries of the world, in view of the very different conditions that have in-

<sup>34</sup> Jorge Mendez, *Op. cit.*, p. 137.

<sup>35</sup> *Minimum Wages in Latin America*, *Op. cit.*, p. 169.

<sup>36</sup> C. Farnsworth, *The Agriculture of Uruguay*, Foreign Agriculture Bulletin No. 3, Office of Foreign Agricultural Relations, USDA, Washington, D.C. 1952, p. 23.

fluenced economic development in the United States. Each country now undergoing economic development has its own set of unique and differing conditions.

In the United States agricultural development was, in its earlier history, shaped by availability of free or nearly free land for settlement and thus developed the structure of family-operated and family-owned farms. This contrasts with the land hunger and great numbers of landless workers among the agricultural populations of the densely populated, underdeveloped areas of the world. Free, democratic institutions in the United States, along with relatively high educational levels and political and economic freedom, have nurtured and promoted individual initiative and economic growth. This contrasts with the colonial status (until recently) and tradition-bound mores and practices of many of the presently underdeveloped countries. Industrialization and urbanization in the United States have afforded to farm people alternatives to remaining on the land. The availability of alternative opportunities has tended to prevent retrogression in agricultural labor conditions and has also exerted a leverage toward giving farm workers the gains in real wages and other conditions that minimum wages and other labor standards legislation have as their objectives.

Reasoning by analogy does not provide a conclusive answer one way or another as to any specific relationship of labor standards in agriculture to agricultural and general economic development. We know that in underdeveloped countries the bulk of the working population is engaged in agriculture. However, wage laborers in agriculture comprise only a relatively small proportion of the entire agricultural working force with the majority of the workers being farm operators and unpaid family workers. Hence, if labor standards are viewed solely in terms of the wage and working conditions of agricultural wage workers, such standards, when in effect, could apply to only a minority of the agricultural population.

In areas where plantation or other large-scale commercial agriculture prevails, labor standards, including minimum wage regulation, may provide an important lever in the raising of living and working standards. But, except for these instances of agricultural development in which the conditions of work take on the characteristics of an industrial enterprise, improvement in the position of agricultural workers in the underdeveloped areas of the world depends upon a broad program for rural development in which labor standards comprise only a small part. The rural development programs being pursued by the economically underdeveloped countries, often with the aid or technical assistance of international agencies and advanced countries, include fundamental improvements in agricultural production techniques, land reform, and broad attacks on problems of nutrition, health, and education.

## LABOR STANDARDS AND WAGES IN AGRICULTURE IN UNDERDEVELOPED COUNTRIES

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M R. DUCOFF has clearly shown that legislation on minimum wages and other objective labor standards in agriculture cannot easily be implemented. I want to go further. Basically, a general level of wages expressed in money terms is foreign to agriculture in underdeveloped countries. Even where the peasant produces only for the world market, such as a small-holder in rubber, what counts is farmers' income over the day, or month, or year and not a wage level for laborers. Where labor is paid, a share of the product is generally preferred by both parties over a nominal sum. And quite rightly so when the price of the export product fluctuates violently.

Payments in money are not uncommon, even in growing food crops. I found this already in records in the late eighteenth century on Java. But they are generally for seasonal-peak labor. Nobody depends on it for a living, and just as often perhaps this labor takes the form of mutual assistance, paid for in kind.

There is a systematic relation between effort and payment in agriculture but it cannot be expressed in a wage level. In Indonesia widespread studies have been made of the earnings of peasants on their own land, per hour of labor. The remarkable outcome was arrived at that value added per hour of labor was a constant figure over a wide area where soil fertility is reasonably good and for a great variety of crops (the equivalent of 2 kilograms of rice per hour). But in poor areas with eroded soils, it was 30% lower. There must be a fair amount of flexibility and choice of crops to obtain this equalization, which of course works through the price mechanism on the domestic market.

But the average income level of the peasant cannot be translated into a wage level that might induce the peasant to work on an estate or in a factory. That level is considerably higher. How much? At least the cost of an out-of-door meal and perhaps a premium for losing one's independence. I found people expressing themselves—as a laborer one can earn more, but one also eats more, so what is the advantage of harder work? When a laborer has to move from his home for seasonal labor, or for good, the necessary differential becomes much greater. With equal standard of consumption, life costs 40% more in a town than 30 miles inland in a village on Java.

\* This contribution is the responsibility of the author and does not necessarily reflect the opinion of the Bank.

It has been my experience on Java that—except on interisland travel—there is a great deal of mobility among laborers. I have seen people in groups of 20 or 30 coming on bicycle, a distance of 200 miles to find work in Djakarta. But this mobility is largely a child of hardship and often of a seasonal nature.

Every year, in the twenties and thirties, at least 500,000 laborers from Java moved temporarily from their village for seasonal labor on sugar, coffee and pepper. All of them were drawn from the sector of peasant agriculture. In addition, at least a million people worked on estates with their home in the village as a basis of operation. In October, 1936, the government issued a decree that after the devaluation of the guilder of that date, real wages on estates must not decline. It then became necessary to collect detailed statistics of wages and study the budgets of laborers. The outcome—unfortunately never published because the data were destroyed at the time of the Japanese attack—was that the wage pattern on estates was closely adapted to the intricate pattern of remuneration and payments in peasant agriculture. It would have been absolutely meaningless to set up over-all minimum standards. A reasonable minimum for seasonal labor in the fields is much too low for other types of work and it is in the latter, not in the nominally low wages in the production of food that exploitation of labor could easily occur. At the same time, on any single type of estate, high and low daily wages had a spread between 100 and 400, according to type of work, season and region. Only through very detailed statistics, could averages and a trend over time be established. The government had to confine itself to comparing these trends for sugar, tea, rubber, coffee estates and by region and pick out slow movers through checks in the field. On the basis of such statistics, it would be possible to order an over-all increase in real wages and check the outcome statistically.

But even here, the mobility of labor between the village and the factory can play dirty tricks. In Indonesia people are accustomed to work in small teams under a foreman who is to a large extent responsible for their performance and behavior. So this foreman screens applicants. In 1936, I observed a case where the British American Tobacco Company paid wages far above the standards in the village, too far above. I found that people paid up to 150 days wages in order to get on the payroll. The whole village had joined in a savings cooperative to get one of their men in that factory. This is an extreme case; but part of the differential between controlled wages in the factory, the mine or on the estate and marginal income in peasant agriculture, inevitably goes to the middleman.

On the other hand, where the labor market is more or less isolated and homogeneous, it is perfectly possible to set minimum wages and

other labor standards. In the former Netherlands Indies this has been done, and successfully, since the early years of this century for labor on agricultural estates on Sumatra. Of course, the government labor office has policed the execution of these labor regulations.

Would this mean that hardly anything can be done in underdeveloped countries on labor standards? I would not draw that conclusion. But the application of objective labor standards can only be achieved step by step. If the legislation enables the labor office to take measures, the starting point should be to define isolated areas with a rather homogeneous labor force. Working from there, gradually draw more variable and fluctuating types of labor into the picture.

In 1940, in the Netherlands Indies a tripartite labor board was set up—10 representatives of management, 10 of labor, and 10 independent government nominees. The conclusions of this body never were arrived at with any of the three groups voting as a bloc. The facts of the case had to be put on the table to win the votes of the independent members. As the board could make binding decisions in setting up wage standards and other conditions of labor for particular cases, a large amount of research had to be conducted in order to reach equitable decisions. Without a mechanism of that kind, I can't see how legislation could basically improve labor conditions in the complicated situation of a so-called underdeveloped country.

## MINIMUM WAGES AND OTHER LABOR STANDARDS CONSIDERED IN RELATION TO ECONOMIC GROWTH IN UNDERDEVELOPED COUNTRIES

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I WOULD like to conclude the session this afternoon by dealing with an aspect of the general question not directly referred to in the perspective papers which have preceded me, namely the stake of trade unions in minimum wage legislation.

Despite the extraordinary efforts of international trade union organizations in the underdeveloped countries, there has been a notably weak interest on their part in the promotion of minimum wage and labor standards legislation. Most of the technical and financial assistance that organizations like the International Confederation of Free Trade Unions and even national federations, such as the American Federation of Labor, have rendered in the past has centered on organizing the unorganized, setting up educational programs for present and potential leaders, and making suggestions, often quite irrelevant to the prevailing economic and labor relations situation, on how to collect dues regularly, on how to draw up model collective agreements and the like.

The reasons for channelling the available limited resources for international trade union assistance into such activities are close at hand. Most of the union personnel involved in one form or another in technical aid to underdeveloped unions come from mature labor organizations in economically advanced countries where collective bargaining, not legislation, has been the primary medium for the attainment of union objectives. The United States, however, may be a somewhat more extreme case than most European countries. Furthermore, unionists on "temporary service" in international activities usually have not taken their apprenticeship in industries like agriculture and retail trade and others, which have been the objects of the provisions of protective labor legislation in their own countries.

In view of the possibilities inherent in campaigns for minimum wage laws, for an increase in the minimum where such laws exist, for more adequate enforcement of existing legislation, or for improved labor standards in most of the underdeveloped countries, it seems surprising that an organization with such broad interests and responsibilities as the ICFTU has not done more to urge such approaches upon its affiliates in Asia, Africa, and Latin America. Considering the enormous number of resolutions that have come out of the various ICFTU meetings in past years, the adoption of a single statement more than two years ago

(Stockholm 1953) favoring the establishment of minimum wages by legislation where feasible seems far below parity. In only one case, the Philippines, has a labor movement actually come to the ICFTU for assistance with a problem involving minimum wages. This case concerned the dispute between the Secretary of Labor and the Secretary of Agriculture to which Mr. Ducoff already referred. In this instance, the ICFTU supplied the Philippine trade unions with an excellent set of arguments against the efforts of the Secretary of Agriculture to abrogate minimum wages or to reduce them in agricultural sectors of the Philippine economy. Unfortunately, the trade unions were not entirely successful.

What reasons can be cited in support of the position that greater emphasis on the attainment of legislation for minimum wages and labor standards would be beneficial both to the objectives and the strategies of trade union movements in underdeveloped countries?

1. Since minimum wages are frequently designed to raise the remuneration of the lowest paid workers employed, and usually in industries with the lowest labor standards, the promotion of minimum wage legislation fits ideally into the humanitarian objectives of trade unionism, concerned, as it is, with providing at least a minimum of nourishment, clothing, housing, health care, and education for the worker and his family.

2. There is little ground for concern that minimum wage legislation will result in deemphasis of collective bargaining. The obsolete arguments of Samuel Gompers and the AFL against governmentally provided labor standards apply even less to the underdeveloped areas than they ever did to the United States in the first and second decade of this century.

3. Advocacy of minimum wages is entirely in harmony with the consumptionist views of union movements everywhere. They can always be expected to stress the "positive" side of the argument, i.e., greater purchasing power leading to increased employment, rather than those arguments that stress the adverse employment and investment effects of minimum wages and adequate labor standards.

4. Minimum wages are normally achieved through legislative or political processes, rather than through bargaining or economic processes. The emphasis on the political element fits in perfectly with the usually encountered proclivity for political activity among nascent trade unions. Where employers refuse to grant recognition and are strong enough to deny trade unions any form of collective bargaining, political activity can still be utilized for the achievement of limited economic objectives. In other words, political efforts need not be used exclusively, as is so frequently the case, for the purpose of securing far-reaching modifica-

tions in the prevailing political and social order. Rather they can serve, as in this case, the immediate economic interests of the labor movement.

5. In those underdeveloped countries where trade unions have achieved positions of strength in limited sectors of the economy, the establishment of minimum wages or a rise in the minimum can be used as the basis for attempts at upward changes in collectively bargained rates. Thus, even unions not directly concerned or not likely to benefit directly should be interested in the provision for minimum wages and standards by legislation.

It would thus seem to me that the trade union movement could make a significant contribution to the economic development of the underdeveloped countries by concentrating more of its efforts on the attainment of basic labor standards—and perhaps a little less on radical political and economic changes.

## MINIMUM WAGE REGULATION IN UNDERDEVELOPED COUNTRIES

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THE RAISING of living standards in underdeveloped countries is one of the major tasks with which the world is faced today, and the regulation of wages in these countries is made difficult by their present extremely low standards. Also the experience of advanced countries can be usefully applied only if full allowance is made for the wide differences in economic conditions and wage levels. People in advanced countries often fail to realize how low are the living standards of a large part of the world's population, and a few facts must be noted to indicate the magnitude and complexity of the problem.

An impressive report published by the United Nations in 1952 indicated that more than one-half of the world's 2,400 million people live on diets insufficient for physical well-being and in houses that do not meet basic human needs.<sup>1</sup> Although they spend most of their income on food their average calorie intake in 1950-51 was less than 2,000 compared with more than 3,000 in advanced countries. Most of the world's serious poverty is in South and South East Asia, Africa and South America. It is estimated that in 1950, Asia, with one-half of the world's population, produced only one-tenth of its income, whereas 7 per cent of the world's population in the United States and Canada produced 43 per cent of its income. Almost all countries in Asia and Africa, most countries in South America, and several countries in South Eastern Europe had average incomes per head in 1950 of less than U. S. \$150; in many of these countries it was under \$100 and in some under \$50, compared with \$600 to \$800 in North Western Europe and more than \$1,400 in the United States.

Poverty in the world's underdeveloped regions is almost always associated with high proportions of the population working in agriculture and with low incomes because of low production per head from agriculture. In Africa nearly 75 per cent and in Asia 70 per cent of the population are rural, compared with 33 per cent in Europe and 20 per cent in the United States. Primitive implements of centuries-old types, and hand sowing, hand transplanting and harvesting, are in general use. Output in metric tons per person engaged in agriculture in North America is ten times that in Asia.

In Burma, which the author of this paper visited recently as adviser on wage regulation under the Technical Assistance Program of the Inter-

<sup>1</sup> United Nations, *Preliminary Report on the World Social Situation, with Special Reference to Standards of Living*, New York, 1952.

national Labour Office, about 5% million out of a total occupied population of 8 million work in agriculture either as owner-cultivators, tenant farmers or labourers. A usual daily wage for labourers in agriculture and rice milling was from 2.0 to 3.5 kyats a day, or the equivalent of 55 to 75 U.S. cents, while annual wages were less in proportion owing to seasonal underemployment and unemployment which is a feature of agriculture in most underdeveloped countries. In West African territories where the author has made wage investigations, rates for unskilled labourers are even less, often being the exchange equivalent of 40 U.S. cents or under a day. Many millions of people in the world earn in their own currencies wages that range from the equivalent of less than \$10 U.S. to \$35 a month, and after making the fullest allowance for cheapness of food and other commodities these represent severe privation.

### *Objectives of Wage Policy*

The data given above indicate the magnitude of the problem and the urgency of adopting sound measures to raise standards of living in underdeveloped countries. The populations of these countries are becoming increasingly aware of how seriously underprivileged they are, and are stirred by aspirations for better standards but are uncertain what to do. Some of them look to industrialization as a solution, but are anxious to avoid the miseries suffered by workpeople during the early stages of industrialization in the now advanced countries. They seek ways to bypass such evils. Economic progress and the raising of wages and standards of living can only be slow, especially as resources for improving capital equipment in industry, agriculture and transportation are meagre. Some advances may be made by reducing exploitation of labour and also, but only to a small extent, by lessening inequalities in the distribution of income. Investigations show that one of the factors responsible for the low standards of living of peasant-cultivators and labourers is the greater inequality in income distribution than in advanced countries, this being caused partly by concentration of land ownership, insecurity of tenure by tenants, ignorance of the peasants and monopolistic advantages enjoyed by distributors of goods.

Specific objects of wage regulation include: (1) abolition of abuses in the payment of wages, such as unfair deductions; (2) the fixing of wage rates in occupations where the workers are too weak to protect themselves; (3) ensuring to the workers a fair share of the results of economic development. The purpose should be to fix the best levels practicable in the early future, and a fair long-term participation in the benefits of progress. A progressive raising of wages, by increasing the nutrition of the workers, is likely to lead to greater productivity, and puts pressure on inefficient employers to improve their methods. Efforts must be concen-

trated first on levelling up the lowest wages in any occupation and on bringing about greater standardization in the wage structure in place of a chaos of different rates. Regulation must achieve something more than a mere legal confirmation of existing rates.

### *Need for Government Regulation*

Experience has shown that the best method of regulating wages is by collective agreements between employers and trade unions, and it should be used wherever practicable. In underdeveloped countries, however, trade unionism is so weak as to be useless at present for this purpose in large sectors of the economy. All available information shows that in agriculture, handicraft occupations and ordinary labour, trade unions scarcely exist in underdeveloped countries. In industries where they have been formed their membership is usually only a small part of the total number of workers, their finances are weak and often badly managed, and their leaders are more concerned with politics than with trying to improve working conditions for their members. Only in a few occupations, which may include railroad transport, longshoremen, teaching, mining, oil field work, sometimes plantation work and one or two factory industries, are trade unions even moderately strong. With few exceptions, therefore, if wages are to be regulated at all, this must be done by the government until such time as collective bargaining can be effective.<sup>2</sup>

The problems of wage regulation that the governments of underdeveloped countries must face are much bigger and more difficult than those of governments in advanced countries. Most workers in advanced countries can take care of themselves, and governments need to intervene only in the relatively few occupations where collective bargaining is inadequate and where wages are unduly low. In some advanced countries government intervention has been limited to industries in which workers are difficult to organize, or even to women and young persons or to home workers only, on the ground that they are most liable to exploitation. As already indicated few workers in underdeveloped countries are effectively organized and almost all wages are very low. Also the extremely low incomes of peasants and others working on their own account, who greatly exceed the number of wage earners, act as a drag on the wages of employed labour. Any substantial improvement in the wages of employed persons would result in the labour market being flooded by those hitherto self-employed unless their incomes had risen in similar proportion.

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<sup>2</sup> This necessity was recognised in Report 1, *Problems of Wage Policy in Asian Countries*, prepared for the Asian Regional Conference of the International Labour Organisation, Tokyo, September 1953.

*Methods of Regulation*

Some countries have used the simple method of passing laws or issuing government decrees fixing minimum rates for general country-wide application or with differences according to region. It is an attractive idea in countries with low levels of wages thus to fix rates below which no worker shall be employed, and this method has been adopted in the Philippines, and also in Peru, Paraguay and Haiti.<sup>3</sup> It is, however, severely limited and is usually of little value unless supplemented by other forms of regulation. It cannot make proper allowance for differences in the capacity to pay of various industries. If the minima are fixed at the level of the lowest paid industries the system merely gives legal force to existing standards, while minima considerably above this level, if suddenly applied, cause dislocation and unemployment in industries that cannot afford them. It does not take into account the considerable differences in wages that investigations have revealed between broad categories of occupations, levels being usually higher in towns than in villages, in industry than in agriculture, in factories than in traditional handicrafts, and in big plantations than on small farms. Political factors may play too great a part in deciding what minima to fix, while adjustments are rarely made frequently enough to allow for changes in economic conditions and in the cost of living.

The method of setting up wage boards or councils to fix rates for particular industries is more flexible and is much more widely applied. These bodies may either be autonomous, each fixing rates independently within their respective industries or preferably they make recommendations that are subject to review by a central authority for the country or a region in order to ensure the application of similar principles by each board. The boards should consist of representatives in equal numbers of employers and workers in the industry concerned together with several independent persons appointed by the government.<sup>4</sup> One difficulty is that the system may involve the establishment of a large number of boards and there may be a shortage of suitably qualified independent people. There is also lack of trained economists and administrators, and of information on actual wages, cost of living, employment and economic conditions in the various industries. In consequence, policies must frequently be based on approximations and fragmentary data.

Most underdeveloped countries have arbitration systems for settling

<sup>3</sup> See *Minimum Wages in Latin America*, International Labour Office, Studies and Reports, New Series, No. 34, Geneva, 1954.

<sup>4</sup> The equal participation of employers and workers is regarded as essential in the International Labour Organization's Conventions on Minimum Wage Fixing Machinery.

industrial disputes, and wage rates, often with statutory force, are fixed in arbitration awards. These rates are fixed only when disputes arise that are referred to arbitration, and therefore arbitration does not provide a method for the continuous regulation of wages. However, the provisions of arbitration awards may influence the wages of workers not subject to the terms of the awards. The influence on private employers of the government's wage policy for its own employees is also very great in underdeveloped countries. Governments in such countries are usually the biggest employers of labour, in public works, railroads, health and welfare services, and the rates fixed by a government are often adopted with only slight modifications by large-scale mining, plantation and other private undertakings, especially those controlled by expatriates. Such employers consider that they cannot be seriously criticised if they pay the same or slightly higher rates than the government. Small-scale native employers, however, often pay considerably less.

Many minimum wage laws require boards to fix rates at levels sufficient for the needs of the worker and his family, while taking into consideration the capacity of industry to pay. In some underdeveloped countries, however, for example, in some parts of East Africa, it has been customary for employers in urban occupations, plantations and mines to pay "bachelor" wages. The labourers seek employment away from their native villages, leaving their wives to maintain themselves and their children by cultivating their plots of land. This system causes social evils and also an unstable labour force, as workers frequently return to their villages for long or short periods. The bachelor wage should be replaced by a family wage, which would facilitate more permanent settlement of labour.

The fixing of minimum wages is of little value unless the rates can be enforced. Difficulties of enforcement are great in industries with large numbers of small undertakings and particularly in agriculture where the workers are usually spread over wide areas. This is one of the reasons why, although the need is great, many minimum wage laws in underdeveloped countries exclude agriculture from the scope of the legislation. Another difficulty in agriculture is the system of payment in kind. Even in advanced countries agriculture was the last major sector of the economy to which statutory regulation of wages was applied, and in some of these countries, for example, England and New Zealand, its application has been made practicable by the adoption of a system of guaranteed prices or markets for farm products. In some underdeveloped countries, however, for example, Brazil, Mexico, the Philippines and Burma, minimum wage legislation specifically includes agriculture. Many countries have passed laws of wide scope, but have applied them only to a few occupa-

tions or even to none at all, and the gap between law and practice is often big. This is partly because of inherent difficulties and lack of qualified people, but also because of cautiousness and a desire for experience when moving along a new untrdden path. In consequence, the great majority of workers in underdeveloped countries are still without effective wage regulation, and this is especially true of agriculture and rural industries.

Many countries have passed protection of wages laws that require wages to be paid regularly, preferably not less frequently than once a fortnight, and make illegal unfair arbitrary deductions or fines. These laws impose restrictions on payment in kind, and provide that workers shall be under no coercion to spend their wages at stores belonging to their employer, and that workers shall not be required to make payments from their wages for the purpose of obtaining or retaining employment.<sup>5</sup>

In some underdeveloped countries a special difficulty arises because some employers arrange with a contractor to find labour to do specified jobs, and the contractor and not the real employer pays the wages. In Burma, for example, this system is traditional in the rice milling industry. A contractor, known as a maistry, undertakes to move paddy from boats in the creek alongside the mills. He recruits coolies, often from distant villages. He may advance money to them, charging excessive interest, at monthly rates that may be the equivalent of 50 to 100 per cent or more a year. He may also arrange accommodation, often of very poor quality. He deducts debts and interest before paying wages, but many coolies never get rid of their indebtedness. The system has so many abuses that if wages are to be regulated effectively the employer should be made responsible for payment of wages directly to the workers, and the maistry or other labour contractor should be paid a wage for the services he renders.

#### *Economic Aspects*

It is a much repeated truism that higher wages and living standards in underdeveloped countries depend on economic development to raise output per head. Also wages policy should be designed to accelerate economic development. Consideration must be given to available supplies of consumers' goods, because if they are seriously limited, perhaps by inadequate facilities for transport from a distance, a substantial rise in money wages will mainly cause inflation so that benefits go less to the workers than to traders who hold or can get stocks of commodities.

Capital for development is scarce in underdeveloped countries, and

<sup>5</sup> See Convention (No. 95) Concerning the Protection of Wages, adopted by the International Labour Conference, 1949.

average living standards are so low that saving for investment can only be slow and on a small scale. The masses of the population can do little by reducing present consumption to provide substantial amounts of capital. However, in village industries, for example, carpentry, metal working and pottery, traditional methods are often so primitive that quantity and quality of output can be increased considerably by the introduction of simple devices involving little capital.

Where political conditions and economic prospects are favourable, large-scale capital provided by wealthy people within the country or by foreign interests is invested in underdeveloped countries, and modern equipment and methods in use in advanced countries are introduced in mines, oil fields, plantations, steel, textiles and other industries. These undertakings could afford to pay high wages, but their demand for labour is so small in relation to the almost inexhaustible supply of low paid labour that they can get all the workers they need at wages little more than the generally prevailing rates. This may enable them to make big profits, some of which the government can by taxation divert for development purposes, but care must be taken to avoid a rate of taxation so high in relation to risk that investment is retarded or prevented.

Not infrequently wages and standards of living in underdeveloped countries fluctuate widely because of big variations in the prices of their products in world markets. Such disturbing changes can be reduced by the use of marketing schemes by which reserves are built up in years of high prices and paid out when prices are below the estimated long-term trend.

The ignorance, disease, poverty, low productivity, lack of capital and increasing pressure of population on inadequate resources, form a vicious circle in underdeveloped countries that is difficult to break. Progress will depend on many kinds of attack. One promising way is the vigorous application of community development programmes such as that started by the Government of India in 1952, which aims to raise standards of output, health, and education in more than half-a-million villages comprising more than 80 per cent of India's teeming multitudes. The scheme is one of practical self-help stimulated and assisted by technical specialists and trained field workers. Attention is directed to improvements in agriculture by better seed, fertilizers, destruction of pests, better methods of animal husbandry, better tools for farming and cottage crafts, better water supply for drinking and irrigation, land reform, rural credits and cooperatives, improvements in feeder roads to markets, suppression of malaria and other diseases, and better education. Use is made of audio and visual aids and demonstration work in the villages. This is a long-term programme. It can be viewed with cautious optimism, and advanced countries by their "know how" can make valuable contributions.

# STATISTICAL ANALYSIS OF SUPPLY RESPONSE IN LATE SPRING POTATOES IN CALIFORNIA\*

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## *Introduction*

THIS paper specifies, and attempts to quantify, the major economic determinants of the supply of late spring potatoes in California. Interest in this problem arises from two sources. (1) Supplies and prices of late spring potatoes in California have fluctuated widely in recent years, with prices declining to levels approximating harvesting costs during years of relatively large acreage. (2) Late spring potatoes are one of several alternative cash crops that farmers in the southern San Joaquin Valley of California can produce. The empirical findings pertain to a limited geographic area, but the method of approach—and particularly possible applications of the results—are thought to be of broader interest.

The concept of supply response has been introduced to express average relationships, over the period studied (1929-1953), between the supply of late spring potatoes and the specified variables that are thought to determine that supply in large part. Regression techniques are used to estimate the relationships between late spring potato acreage and selected variables. Possible uses for the estimated parameters are demonstrated (1) as prediction mechanisms, and (2) as a basis for acreage (and supply) regulation through the establishment of a price system with given inter-commodity price relationships. The second application of the findings of this study is presented in the form of isoacreage maps, with prices serving as coordinates.

Alternative approaches to statistical treatment of supply response are considered briefly. The use of cross sectional data and time series within either one of two general frameworks is discussed. Empirical analysis is confined to time series of one equation drawn from a general model of the late spring potato industry. The factors affecting supply are divided into those affecting yield and those affecting acreage. The acreage equation is viewed as the aggregate result of the planning of individual late spring potato producers. Both the yield and acreage equations are formulated within the general model and contain only predetermined independent variables (exogenous or lagged endogenous). Therefore, least squares estimates of the parameters are both consistent and efficient.

## *Alternative Approaches to Supply Response Analysis*

Before detailed explanation of the model and variables is undertaken, a brief consideration of alternative approaches to the problem of estimat-

\* Giannini Foundation Paper No. 150. For a full report of this research see Chester O. McCorkle, Jr. and Yair Mundlak, "Statistical Analysis of Supply Response in Late Spring Potatoes in California," *Hilgardia*, Volume 24, Number 18, University of California, Berkeley, California, April 1956.

ing supply response might assist in evaluating the techniques of this study. One approach would utilize some of the tools of production economics—budgeting or, more formally, activity analysis—to determine the expected individual firm response. Where sufficient homogeneity prevails among farms in the area or where percentages of the aggregate acreage composed of farms with specified characteristics are known, this approach would be fruitful with one major exception. This type of analysis would tell the researcher what *should* be done for individual firm profit maximization, not what *is* done within the context of diverse entrepreneurial goals and expectations. This approach may assume alternative sets of input-output ratios, price and cost expectations, and values for the other parameters. However, individual operators may have unique expectations for these parameters quite different from the range considered. At best it provides an indication of how "rational" farmers should behave in a system of alternative static positions, each position being carefully prescribed. This is not to reject this approach *per se* but merely to point out its limitations as a single basis for acreage prediction. When used in conjunction with other approaches, these limitations may become less important as information explaining differences in observed and calculated allocations becomes available from other approaches.

In contrast to this normative type of approach, the problem of supply or acreage response can be treated directly by formulating a statistical model indicating factors associated with acreage and production changes. At least two types of data can be used in this second approach. One possibility is to draw on data from a cross sectional sample of farms. These data would consist of observations on organizational adjustments made by individual farm operators during some given period of time. In this approach additional variables can be included that would be difficult to inject in an aggregative model. Time series analysis of available aggregative data presents another possibility. The estimates of parameters in the model from analysis of data taken from a stratified random sample of farms, or other appropriate sample design, could be expected to provide a more adequate predictive device (at least in the short run). These estimates would be based on a larger sample, resulting in narrower confidence intervals than would be obtained from a time series analysis, in which the availability of "good" data is limited both physically and by the need for continuous caution against inclusion of periods involving material structural changes. However, the construction of accurate aggregate acreage estimates from individual predictions of allocation based on cross sectional data may prove difficult. Additional error may be introduced in the process of aggregation as a result of incorrect weighting.

From a practical point of view the choice between the two methods

compared is strongly affected by the cost of procuring data. Cross sectional sampling of a large number of farms, regardless of how desirable it may be, is comparatively expensive, both in time and money. Largely for this reason, statistical analysis of aggregative time series data has been employed in this type of study.<sup>1</sup>

Any statistical formulation of the supply response function should take into consideration at the onset the joint relationships that may exist between the disturbance term of the supply equation and those of related equations. Such a model would include a supply response equation for each of the alternative enterprises faced by the potato producers as well as a set of equations specifying the demand for the products of each of these enterprises. Obviously if the number of alternatives were large and the demand and supply equations were interrelated such a model would be too intricate to handle practically. Therefore, the operating model must be reduced in size. In so doing, two alternative sets of assumptions can be made. First, it can be assumed that the joint relationships between the various supply response equations are more important than those that exist between the supply and demand of each crop. This will narrow the original general model down to an acreage allocation model that will include, in addition to the acreage response functions, equations that describe the determination of the total acreage planted, the amount of water used and the utilization of other resources that play a role in the decision about acreage allocation.

An alternative to this is a model based on the assumption that the interdependence of the supply response equations with their respective demand equations is more important than the relationships between the various supply response functions. In this model the prices to which farmers respond are not taken as given or known at the time the decision on acreage allocation is made. Instead it is postulated that the farmers respond to the expected price as derived from the demand equation. Such an equation, in the case of California late spring potatoes, would include variables describing the stock situation, the supply from competing areas, supply of the California crop and a measure of consumers' income. With an estimate of the expected competing shipments and data on income and stocks, the expected price and the expected supply of the California crop would be determined simultaneously.

Alternatively, in this study the expected prices are approximated by

<sup>1</sup> Since each of the three alternative methods mentioned have serious shortcomings in predicting aggregate acreages it might prove fruitful to consider a combination of approaches. One alternative is to compare the aggregates constructed from the normative, the cross sectional, and the aggregative time series approach. Aggregates in the case of the normative and cross sectional approaches could be obtained by applying appropriate weights to the synthetic models and sampling units respectively.

lagged prices that are exogenous to the system. Consequently the supply becomes independent of the demand equation. The result is a simplified acreage allocation model. It is simplified in the sense that some of the variables that are believed to affect the acreage allocation were not included in the analysis. Lack of data was the primary consideration in their exclusion. Such variables are (1) availability of water in the potato producing area and (2) availability of seasonal labor. Additional simplification was made in considering the total cultivated acreage in Kern County, where the bulk of the crop is produced, as an exogenous variable.<sup>2</sup> This permits an independent treatment of the potato supply function.

### *The Supply Function*

The supply can be viewed as being the product of two components, acreage and yield. The decisions made by producers regarding planted acreage must be completed by the end of the planting period. Furthermore, each individual producer ordinarily has full control over the total acreage he wishes to plant.

However, variations in yield arise from season to season, both from natural causes and from changes in production practices. Decisions regarding yield influencing production practices are made both before and during the growing season. It is desirable to test the hypothesis that yield response to short run changes in economic variables is not important in altering total supply.

The yield relationship can be expressed as

$$Y = f(G, L, Pe) + u$$

where yield ( $Y$ ) is depicted as a function of the general level of potato yields ( $G$ ), expected price ( $Pe$ ), and the position on the particular production function ( $L$ ) selected by individual producers which is partially determined by expected price. The disturbance term ( $u$ ) is a random variable injected to account for the difference between observed and expected values of  $Y$ . The general level of potato yields is selected to represent the adopted level of technology.

No acceptable measure of the level of intensity of production is available for year-to-year comparisons. Without this variable, the structural relationship reduces to

$$Y = f(G, Pe) + v.$$

The farm price for late spring potatoes received by California producers lagged one year was used to depict the expected price ( $Pe$ ). A moving average yield for the previous five years ( $Y_5$ ), was selected as the variable to

<sup>2</sup>This assumption may not be too serious in view of the fact that potatoes occupied only 5 to 12 percent of the total cultivated area.

approximate the general level of yields. The following regression equation was derived

$$Y = .625 + .892 Y_s - .035 P_{t-1} \quad R^2 = .84 \\ (2.854) \quad (0.175)$$

where the figures in parenthesis are the t-ratios for the regression coefficients for testing the null hypothesis. The regression coefficient for the price variable is not significantly different from zero at any acceptable level of significance. The inclusion of the price variable ( $P_{t-1}$ ) actually reduced the value of  $R^2$ . The simple correlation coefficient of yield and prices lagged one year was .45. An attempt to explain the *change* in yield by *change* in prices was even less successful. The correlation coefficient between first differences in yield and first differences in potato prices lagged one year was found to be  $-.017$ . This analysis suggests that the yield of late spring potatoes can be viewed primarily as a function of level of technology.

The effect of omitting the variable representing the level of intensity of production warrants consideration. The level of intensity of production for any season can be considered a function of the production function employed, the price of the product and the price of the input factors. The production function is reflected directly in the level of technology and was, therefore, implicitly introduced. The price of the product was included explicitly in the yield equation. Therefore the only component neglected was the factor price component. Some degree of short run sensitivity of yield to factor price variation prevails. However, it is believed that planned response to factor prices within the production period is not as important as is acreage in determining the total supply. Subsequent analysis, therefore, involves only the acreage equation.

#### *The Variables of the Acreage Equation*

Late spring potato acreage is determined by the expected relative profitability of potatoes with respect to alternatives, and by total cultivated acreage for all crops in the late spring potato producing areas.

Expected returns are represented by lagged gross returns. Time lags in appropriate variables cannot be determined *a priori*. How potato farmers establish price expectations is not known. Past prices received are considered to be important in determining expected prices. Where more than one year's prices are used, the problem arises as to how to weight each of the years included. Any selection will be arbitrary until further study verifies the nature of expectation formulation. It is desirable to compare the different alternative enterprises on the basis of net returns per acre. Because of lack of appropriate cost data, approximation had to be employed. Two approximations were used. One is gross returns per acre,

TABLE 1. REGRESSION COEFFICIENTS AND AUXILIARY CONSTANTS FOR SEVEN EMPIRICAL FORMULATIONS OF CALIFORNIA LATE SPRING POTATO ACREAGE RESPONSE, 1929-1953 (EXCLUDING 1950)

Equation	Dependent variable	Constant term	Net regression coefficients							$\bar{R}^2$
			$V_p'$	$V_A'$	$V_e'$	$P_p'$	$P_A'$	$P_e'$	$A'$	
1	$A_p$	-15.386	0.028 (.946)	0.440 (2.285)	-0.338 (4.518)				0.148 (4.938)	0.916
2	$A_p$	-38.142	0.621 (6.77)	-0.161 (7.97)	7.462 (1.66)				0.085 (3.44)	0.986
3	$A_p$	-38.254			7.181 (.738)	2.869 (2.972)	-0.707 (1.368)		5.112 (5.063)	(7.29)
4	$A_p$	-36.111			8.218 (.816)	2.802 (2.832)	-0.755 (1.425)	0.032 (.665)	5.112 (4.027)	0.945
			$P_p$	$P_A$	$P_e$	$\log P_p$	$\log P_A$	$\log P_e$	$A'$	
5	$A_p$	-38.197	14.357 (2.511)	1.308 (2.925)	-0.299 (.732)				5.310 (5.357)	0.919
6	$A_p$	-27.126	14.425 (2.450)	1.312 (2.170)	-0.396 (.706)				5.428 (4.586)	0.914
7	$\log A_p$	0.1677				0.237 (2.410)	0.460 (3.069)	-0.229 (1.972)	0.086 (12.470)	0.966

$A_p$ —Acreage of late spring potatoes in California, 1,000 acres  
 $V_p'$ —Gross returns from late spring potatoes in California, dollars per acre, average of years t-1 and t-2.

$V_A'$ —Gross returns from alfalfa in California, dollars per acre, average of years t-1 and t-2.

$V_e'$ —Gross returns from cotton in California, dollars per acre, average of year t-1 and t-2.

$P_p'$ —Prices received by California producers of late spring potatoes, dollars per bushel, average of years t-1 and t-2.

$P_p$ —Prices received by California producers for late spring potatoes, dollars per bushel (cents per bushel in equation 7), lagged one year.

$P_A$ —Prices received by California producers for Alfalfa, dollars per

$P_e'$ —Prices received by California producers for cotton lint, cents per pound, lagged one year.

$t$

$t^2$

$\bar{R}^2$ —Adjusted coefficient of multiple determination.

$P_p$ —Prices received by California producers of alfalfa, dollars per ton, average of years t-1 and t-2.

$P_e$ —Prices received by California producers of cotton, cents per pound of lint, average of years t-1 and t-2.

$A'$ —Cultivated acreage in Kern County planted to annual crops or alfalfa, 1,000 acres.

$t$ —Time, 1928=0.

$t^2$ —Time to the second power.

Figures in parentheses are t-ratios, the value of  $t$  at the 5 per cent level of significance with 18 degrees of freedom is 2.101.

which provides a good approximation when the cost relationship among the considered alternatives has not changed over time.<sup>3</sup> The other approximation is prices received by farmers. This would not be expected to differ much from the first one if farmers put only limited emphasis on year-to-year yield variations in their acreage plans.

A time variable (first and second degree) was introduced to represent the net effect of several variables with the impact of each being too small to warrant inclusion of the variable as a separate independent variable. The final variable employed in this analysis is total acreage in annual crops and alfalfa in Kern County. This variable is introduced as an indirect measure of potential potato land since the bulk of the California late spring potatoes are produced in this county. The alternative enterprises to potatoes employed in this study are alfalfa and cotton. In very recent years the production of such new crops as field corn have been expanded. Should this development continue at the present rate, its inclusion in the model would be appropriate.

### *The Empirical Results*

Seven empirical formulations of the acreage response relations have been presented. In all formulations, time series data for the years 1929-1953 have been used, with 1950 excluded because of cotton acreage restrictions in that year.<sup>4</sup> First degree, second degree, and logarithmic functions have been fitted to the data (Table 1).

<sup>3</sup> The validity of assuming constant cost relationships among alternatives is subject to question. It is possible, for example, that during the war period factor shortages, particularly labor, affected the cotton and potato enterprises more than the alfalfa enterprise on Kern County farms. To assume that the adoption of technological improvements on these farms following the war affected costs of each enterprise relatively equally may also be subject to question. In order to verify or disprove the validity of such an assumption extensive research would be required. Historical cost data of the type required to estimate net returns would have to be developed as well as accurate measurement of relative impacts of technological improvements on the net returns of alternatives. Regardless of their desirability accurate estimates of this type would be extremely difficult to make.

<sup>4</sup> Cotton acreage restrictions were in effect prior to World War II. However, their impact on acreage allocation in Kern County during that period is not considered to have been of sufficient magnitude to necessitate rejection of data from these periods. Prior to World War II, California cotton was not favored by buyers. The farm price for cotton together with yields of the period did not make this crop as attractive an alternative as it was later to become. Although the sharp cotton acreage reduction in California from 1937 to 1938 suggests that restrictions served as a strong deterrent on expansion of the cotton acreage during years of allotments, subsequent data does not substantiate this view. It was not until the end of the war when a high support price, standardization of variety with trade appeal, and mechanization combined to bring about a six-fold increase in cotton acreage in the county in seven years. It is recognized that a case might be built for rejecting these years on the grounds that *any* restriction would cause planted acreage to deviate from the equilibrium level reflecting prevailing market prices.

The first equation derived expresses acreage of late spring potatoes in California as a linear function of gross returns per acre for potatoes, alfalfa, and cotton, and total cultivated acreage in Kern County planted to annual crops and alfalfa. The value of the coefficient of multiple determination obtained when adjusted for degrees of freedom was 0.918, indicating a "good fit" to the data. However, the value of the t-ratio for the late spring potato gross return per acre regression coefficient was not of sufficient magnitude to lead to rejection of the null hypothesis that this coefficient actually has zero value.

The principal difference between equations 1 and 2 is in the inclusion of the time variables in the latter. However, because of the high inter-correlation between late spring potato yields and the time variables, it appeared logical to replace the gross return variable for late spring potatoes with a price variable for late spring potatoes. The time variables reflect yield variation through time but do not carry the price component of the gross return variable. Therefore, the price component had to be introduced explicitly. These changes produced an equation with a high degree to fit  $R^2 = 0.986$ ) and improved the t-ratios for all of the independent variables except that of the aggregate cultivated acreage.

Equation 3 substituted similarly lagged price variables for gross return variables for cotton and alfalfa and excluded the total cultivated acreage variable. The net effect of this change from equation 2 was to reduce the fit of the function and the significance of the regression coefficients. The addition of acreage in equation 4 did not improve the fit or increase the magnitude of the t-ratios of the regression coefficients. Equation 5 expresses California late spring potato acreage as a function of prices of late spring potatoes, alfalfa, and cotton lint (each lagged one year) and the time variables. Equation 6 contains the above variables and also the aggregate cultivated acreage variable. In neither formulation (5 or 6) is the fit significantly superior to that of any of the equations previously discussed. The t-ratio shifted in these two equations as compared with earlier versions. The potato price variable is significant at the 5 per cent level, whereas the cotton price variable is not. If the independent variables for crops were expressed in terms of prices or in terms of gross returns, the adjusted coefficients of multiple determination were generally smaller where values were lagged one year than where two-year lagged averages were used. This is not a general finding resulting from this study as the questions of how farm operators formulate their expectations and how variables should be lagged in statistical treatment of problems of supply response in agriculture requires extensive research.

Recognition of the possibility of joint rather than additive influence of the independent variables on the late spring potato acreage in California



FIG.  
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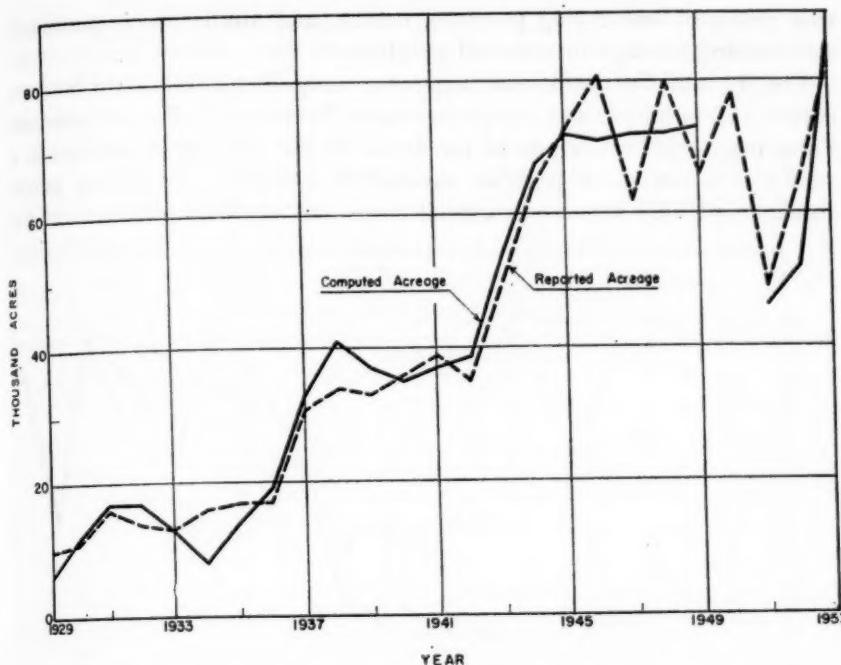


FIG. 1. ACREAGE OF LATE SPRING POTATOES IN CALIFORNIA, 1929-1953 (EXCLUDING 1950), A COMPARISON OF REPORTED ACREAGE WITH ACREAGE ESTIMATES COMPUTED FROM THE MULTIPLE REGRESSION EQUATION (2)

$$A_p = -38.142 + 7.462 P'_p + .621 V'_A - .161 V'_c + .085 A' + 4.253 t - .142 t^2$$

suggested equation 7. An exponential function involving the same variables included in equation 5 produced a superior fit in that the adjusted coefficient of multiple determination increased from 0.919 to 0.966. Furthermore, the t-ratios assumed values significant at the 5 per cent level with the exception of the net regression coefficient for the cotton price variable, which was significant at the 10 per cent level.

One other formulation, though not included in Table 1, was attempted in recognition of the correlation existing between independent variables. This formulation was in terms of first differences and was introduced also for the purpose of eliminating trend which seems to account for a significant portion of the variation.<sup>5</sup> The results of this analysis suggest

<sup>5</sup>This equation, based on data from 1930 to 1953 with 1950 excluded is

$$A_{p0} = 1.724 + 6.222 P_{p0} - 1.728 P_{c0} + 3.073 P'_{A0} \quad R^2 = .820 \\ (2.165) \quad (6.785) \quad (5.481)$$

where the dependent variable is change in late spring potato acreage from the previous year and the independent variables are changes in prices lagged one year in the case of potatoes and cotton and change in the average alfalfa price of the previous two years.

that prices of late spring potatoes, cotton, and alfalfa are important in determining acreage response of potatoes.

The signs of the coefficients suggest a competing relationship between cotton and potatoes, and complementarity between alfalfa and potatoes. Farm organization analysis of the farms in the same area resulted in a similar conclusion. A positive association between late spring potato acreage and total acreage in annual crops and alfalfa is indicative of the

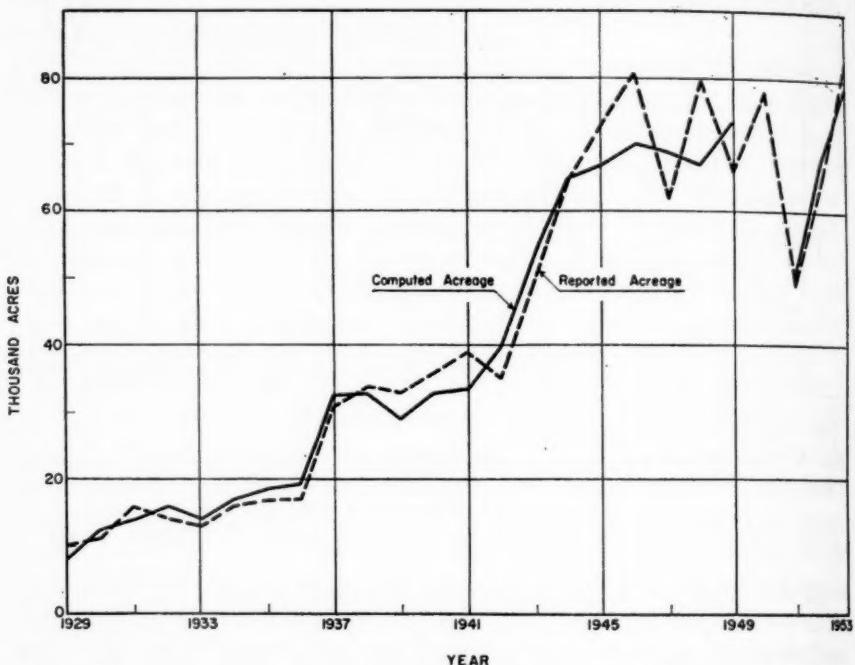


FIG. 2. ACREAGE OF LATE SPRING POTATOES IN CALIFORNIA, 1929-1953 (EXCLUDING 1950), A COMPARISON OF REPORTED ACREAGE WITH ACREAGE ESTIMATES COMPUTED FROM THE MULTIPLE REGRESSION EQUATION (7)

$$\log A_p = .167690 + .236912 \log P_F + .449828 \log P_A - .229049 \log P_c + .086045 t - .002041 t^2$$

fact that potatoes claimed their share of the increased acreage brought into cultivation or displaced other crops more tolerant of conditions found on newly developed sites. The signs of the terms indicate that the importance of the factors represented by the time variable is decreasing. Figures 1 and 2 illustrate the closeness of fit from equations 2 and 7, respectively.

#### Elasticities of Acreage Response

For some purposes it is desirable to present the prevailing relationships between the dependent and the independent variables in relative rather than absolute terms. For example, where interenterprise comparisons of sensitivity of acreage responses to price changes are desired, elasticity

coefficients provide a means of comparison. The elasticities and cross elasticities of acreage response with respect to some of the independent variables, holding the effects of others constant, will indicate percentage changes.

Elasticity coefficients for five of the seven equations have been computed in order to obtain an indication of the association of the three price and gross returns variables with potato acreage (Table 2). These elasticities were computed at the centroid for equations 1, 2, 3 and 5. In

TABLE 2. ESTIMATED ELASTICITY COEFFICIENTS COMPUTED FROM FIVE FORMULATIONS OF ACREAGE RESPONSE OF LATE SPRING POTATOES IN CALIFORNIA<sup>1</sup>

Equation numbers	Independent variables								
	Potatoes			Cotton			Alfalfa		
	P <sub>P<sub>t-1</sub></sub>	P <sub>P<sub>1/t</sub></sub>	V <sub>P<sub>1/t</sub></sub>	P <sub>e<sub>t-1</sub></sub>	P <sub>e<sub>1/t</sub></sub>	V <sub>e<sub>1/t</sub></sub>	P <sub>a<sub>t-1</sub></sub>	P <sub>a<sub>1/t</sub></sub>	V <sub>a<sub>1/t</sub></sub>
1			.277 <sup>d</sup>			-.618 <sub>a</sub>			.645 <sup>b</sup>
2		.223 <sup>c</sup>				-.426 <sub>a</sub>			.912 <sup>a</sup>
3		.101 <sup>d</sup>			-.177 <sup>c</sup>			.544 <sup>a</sup>	
5	.376 <sup>b</sup>			-.137 <sup>d</sup>			.460 <sup>b</sup>		
7	.237 <sup>b</sup>			-.229 <sup>b</sup>			.450 <sup>a</sup>		

<sup>1</sup> Letters in the body of the table refer to results of tests of significance for the estimates of coefficients of elasticity: a = 1%, b = 5%, c = 10%, d = 25%. The results are derived from testing the null hypothesis that  $\epsilon=0$ . A given coefficient of elasticity could be equal to zero only if the regression coefficient were equal to zero. Therefore, the results of the tests of significance applied to the estimates of the regression coefficients can serve as a test of the estimates of the coefficients of elasticity. For a discussion of testing elasticities derived from linear regression equations see M. A. Girshick, "The Application of the Theory of Linear Hypotheses to the Coefficient of Elasticity of Demand," *Journal of the American Statistical Association*, Vol. 39, No. 418, June, 1942, pp. 233-237.

equation 7, which is logarithmic in form, the regression coefficients are the elasticities.

The absolute values of the elasticities as computed from the various equations are all less than unity. Values for elasticities of the cotton and potato variables are essentially less than .5. The conclusion can thus be drawn that acreage response is inelastic with respect to any of the alternatives included in the model.

Some of the estimated elasticity and regression coefficients are not statistically significant at acceptable levels of significance. However, it cannot be concluded that the variables from which these estimates are computed are not relevant. It does suggest that more information is required to verify the importance of these variables, which were introduced on the basis of *a priori* reasoning alone. The high intercorrelations between some of the variables can be cited as a cause for statistical nonsignificance in some of the estimates.<sup>6</sup> Furthermore, the fact that a given

<sup>6</sup> High intercorrelation between the independent variables results in relatively large standard errors of the regression coefficients. See Karl A. Fox and James F. Cooney, Jr. *Effects of Intercorrelation Upon Multiple Correlation and Regression Measures*, U. S. Department of Agriculture, Agricultural Marketing Service, Mimeograph, April 1954.

variable logically included in the formulation is sometimes significant at an acceptable level of significance, depending on the particular formulation, is indicative of its importance.

### Applications

Two possible applications of the empirical acreage response functions will be mentioned. The first, that of prediction, is widely known and used. Equation 7 was selected to predict the 1954 late spring potato acreage in California. The figure obtained is 50,017 acres (the actual figure turned out to be 56,000 acres). The 90 per cent prediction interval is found to be 36,595 and 68,580. This interval is obviously of such a width as to be of limited usefulness. Partly this reflects the small number of observations employed. The time variable also contributes to the wide confidence interval since any observation on time for purposes of prediction is an extreme observation.<sup>7</sup> This is accentuated with the time variable raised to the second power.

The second problem to which the results of this analysis have been applied is perhaps of more interest to economists. This problem involves the achievement of desired acreage (production) goals through manipulation of relative prices. Changes upward or downward in acreage from previous periods would be attainable. Practically, this approach would involve the establishment of a set of relative prices sufficiently far in advance to bring forth the given acreage at the time it is desired.<sup>8</sup> During periods of war this has been one major problem faced by administrators of governmental agencies in the United States charged with the responsibility of obtaining given absolute and relative quantities of various foods and fibers. But this application need not be confined to a wartime economy. An agricultural price program suggested as an alternative to the present price support program would require this type of empirical analysis on an area basis if it proves feasible in practice.<sup>9</sup>

<sup>7</sup> The squares of the deviations between the values of the independent variables used for prediction and their sample means are used as weights in the expression for the variance. Thus the variance is smaller when these variables take values near their means.

<sup>8</sup> This approach to acreage manipulation implies that producers react similarly to prices announced prior to planting and market prices generated in previous periods. This result could be expected of this type of program at its inception and possibly for a period of years. It must be recognized, however, that producers would likely attach a different set of probabilities to announced prices than to the price expectations formulated from market prices in previous periods. This suggests that modification in announced prices might have to be made to achieve desired goals through time as this type of program was operated. The type of commodity and its position relative to alternatives in specified producing areas would determine in large part the effectiveness of such a program through time.

<sup>9</sup> Reference is made to the recommendations of Schultz and Johnson for a system

This type of application possesses conceptual merit, but the difficulties involved in practice must be made explicit. Certainly the accuracy of prediction would have to be improved. Structural changes in the industry may greatly affect the efficiency of the model. Stability of the basic relationships becomes a prime necessity for this application of the technique to be feasible. In any policy application of this type, strict empirical findings would have to stand the scrutiny of experienced judgement before being placed in operation. The following is to be viewed and interpreted within these limitations.

A review of the results of this study indicates clearly that late spring potato acreage in California depends on prices and returns per acre for alternative enterprises as well as late spring potato prices. The simple price-output relationship (in this case price-acreage relationship) depicted by the conventional theoretical supply function is not appropriate. When establishing prices for late spring potatoes that will bring forth a desired acreage, prices of alternatives must also be set that bear the appropriate relationship to the potato price (and production costs for potatoes and alternatives, technically speaking) if the potato acreage goal is to be met. Whether or not a particular price for potatoes is high or low in terms of acreage response depends on the prices of other crops that are alternatives to late spring potatoes in the farm organizations.

This is a partial approach, since it deals only with the acreage of a single crop and disregards the consequences of the price manipulation on the acreage of the other crops. This could be generalized to more than one crop by development of an acreage response equation for each of the pertinent crops and the relative prices. This system is always soluble since there will always be at least as many variables as equations. Likely in most cases there will be some values that will have to be fixed, or more likely predicted, for the given period in order to obtain unique solutions of the pertinent variables as illustrated.

One solution to this problem is demonstrated by this analysis. By setting the California late spring potato acreage goal at the level desired, the potato price required to achieve this goal can be expressed as a function of the prices of alfalfa and cotton, holding other variables in the equation, if present, at given values. This approach can be illustrated by computing the values required from any of the equations. In equation 7, for

of forward prices. One characteristic of these prices as explained by Schultz is that "the prices announced should be those prices which will achieve the desired output," Theodore W. Schultz, *Agriculture in an Unstable Economy*, New York and London: McGraw-Hill Book Company, Inc., 1945, pp. 264-265. A more complete treatment of a forward pricing system with minor reference to some of the statistical problems encountered in putting the system into operation is provided by D. Gale Johnson, *Forward Prices for Agriculture*, Chicago: The University of Chicago Press, 1947.

example, the price relationships that will bring forth any given late spring potato acreage, say in 1954, can be derived as

$$A_{P_{14}} = 11.2775 P_P^{-.237} P_c^{-.229} P_A^{-.460}$$

from which  $P_P$  (price of late spring potatoes in the period preceding) can be determined by

$$P_P = \left( \frac{A_{P_{14}} \cdot P_c^{.229}}{11.2775 P_A^{-.460}} \right)^{1/.237}$$

By substituting a value for  $A_{P_{14}}$ , the acreage goal for late spring potatoes in California, and by establishing a price level for alfalfa, the combinations of cotton and potato prices that will result in the given potato acreage are determinable.<sup>10</sup> If 60,000 acres of late spring potatoes are desired in 1954 and an alfalfa price of \$20 per ton is established, then the relationship becomes

$$P_P = 3.923 P_c^{.966}$$

from which a set of price combinations for late spring potatoes and cotton can be developed resulting in 60,000 acres of late spring potatoes in 1954. Similarly, the price of cotton can be established at a given level and a potato-alfalfa price relationship can be determined that will also result in 60,000 acres of late spring potatoes. This relationship, with  $P_c = \$ .30$  per pound (price of cotton in the preceding period) would be

$$\frac{30.987}{P_A^{1.899}}$$

Although this argument holds in the short run, the problem of acreage response with alfalfa—a perennial crop—would present further problems in the use of relative prices to direct acreage. The values for  $P_P$ ,  $P_A$ , and  $P_c$  that have been interpreted as 1953 values to this point in the argument, could be announced prices.

The numerical examples of these calculations presented have been reduced to two-variable combinations, the third fixed at a specified level to permit graphic illustration. The case where cotton prices are fixed is first considered. The isoacreage lines thus derived are a similar concept to the isoquants of production theory. The coordinates, however, are not inputs but rather prices of the two alternatives being considered. Figure 3 illustrates the price relationships between potatoes and alfalfa given the cotton price at \$.30 per pound of lint, which would be expected to bring forth given levels of potato acreage. With cotton at \$.30 per pound and a price of \$20 per ton for alfalfa, then \$1.05 per bushel for late spring potatoes would be expected to bring forth 60,000 acres of that crop. If the

<sup>10</sup> This assumes that individual producers respond to a price announced before the production period in the same manner that they did to market prices experienced previously.

cotton lint price were reduced to \$.20 per pound, the same acreage could be obtained with \$20 per ton alfalfa and a late spring potato price of about \$.71 per bushel.

The general contour of the isoacreage functions is of interest in light of

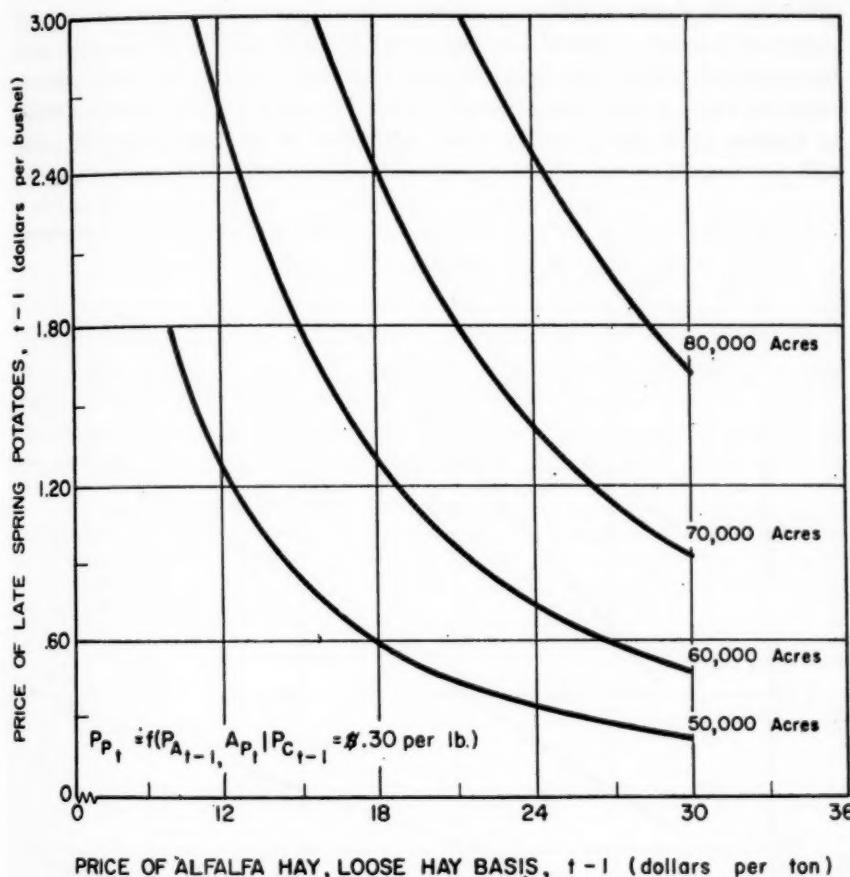


FIG. 3. FUNCTIONAL RELATIONSHIPS OF CALIFORNIA LATE SPRING POTATO PRICES AND ALFALFA PRICES, GIVEN COTTON LINT PRICE AT \$.30 PER POUND WHICH ARE EXPECTED TO RESULT IN SPECIFIED ACREAGE OF LATE SPRING POTATOES IN THE SUBSEQUENT YEAR.

the complementary and competitive enterprise interrelationships existing. Given the cotton price, an increase in the acreage of late spring potatoes can be induced by either an increase in the price of potatoes or by an increase in the price of alfalfa because of the complementarity of alfalfa and potatoes and competitiveness of cotton and alfalfa for the critical water resource. As the potato price reaches lower levels, greater increases

in alfalfa prices would be required to bring forth the given potato acreage. However, small increases in the price of late spring potatoes, when initial prices are relatively low, will result in greater acreage increases than will small increases when the initial price is relatively high.

The graphical illustration of the cases where alfalfa prices are held at given levels shows a different relationship. A given acreage of late spring potatoes can be achieved for any given level of alfalfa prices with combinations of cotton and potato prices that bear nearly constant positive ratios to one another. For example, if 60,000 acres of late spring potatoes in California is the goal for 1954, with the alfalfa price established at \$20 per ton, then this can be achieved with \$.25 per pound cotton lint

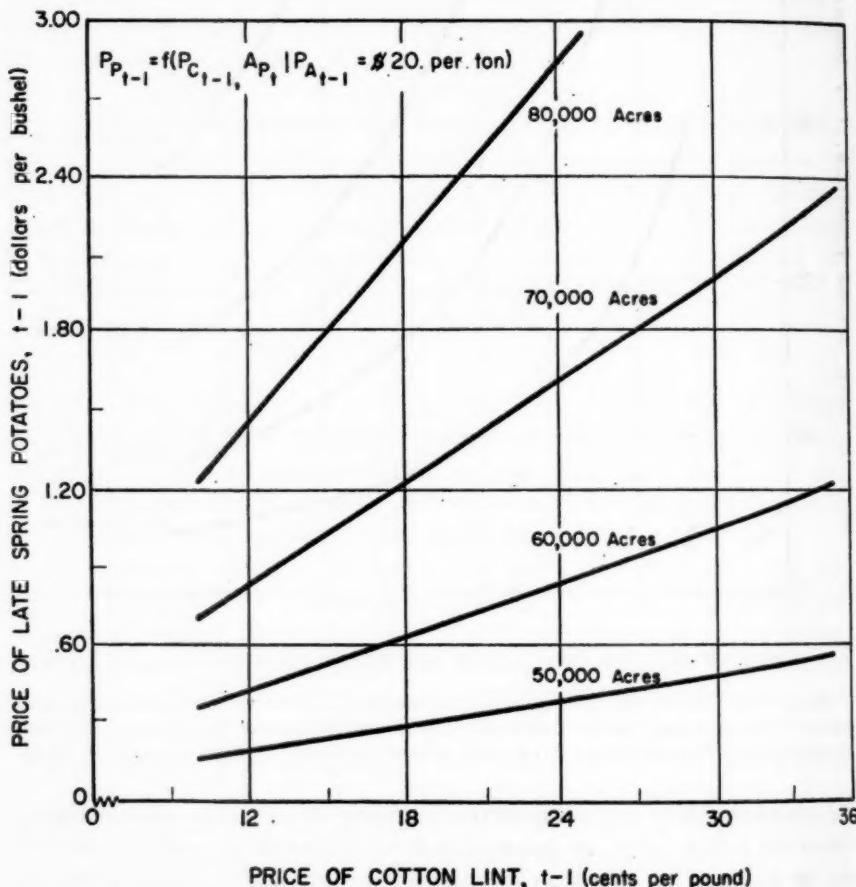


FIG. 4. FUNCTIONAL RELATIONSHIPS OF CALIFORNIA LATE SPRING POTATO PRICES AND COTTON LINT PRICES GIVEN THE PRICE OF ALFALFA HAY AT \$20 PER TON LOOSE BASIS, WHICH ARE EXPECTED TO RESULT IN SPECIFIED ACREAGES OF LATE SPRING POTATOES IN THE SUBSEQUENT YEAR.

and \$.88 per bushel late spring potatoes or with \$.30 cotton and \$1.05 potatoes, a ratio of approximately 1 to 3.5 (Figure 4).<sup>11</sup> For 70,000 acres of late spring potatoes in 1954, a price ratio of approximately 1 to 6.8 would be required.

By increasing the alfalfa price any given acreage of late spring potatoes can be achieved with a reduced price ratio of cotton to potatoes. For example, 60,000 acres would be anticipated when the expected cotton price was \$.30 per pound of lint and the late spring potato price was \$.69 per bushel, a ratio of 1 to 2.3. The relationship required to bring forth 80,000 acres of late spring potatoes is a ratio of 1 to almost 7.7 between the price of cotton and late spring potatoes.

When these findings are applied to practical problems the implications of combinations of values for the independent variables outside the range of observed combinations must be recognized, as well as specific values for independent variables that may not have been observed. Both types of extrapolation can be misleading. The problem of unobserved combinations is more serious in the functions when the relationships are joint rather than additive. In any event, care must be exercised in applying these findings and in interpreting the results of application to problems outside the scope, method, and data of the initial study.

<sup>11</sup> The ratios represent the ratio of cotton lint prices per pound to late spring potato prices per bushel. Although these ratios are not in fact constant over the range of alternative prices required to bring forth any given acreage, they are nearly constant since the exponent in the logarithmic function has the value of .966; a value of 1.0 would result in a constant ratio.

## THE IMPACT OF THE CHOICE OF MODEL ON MEASUREMENTS OF ECONOMIC BEHAVIOR RELATIONSHIPS\*

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THE ESTIMATION of models of economic behavior has become an important tool for the analysis of economic fluctuations and related problems of economic policy decisions by the government and firm. In the process of constructing these models and estimating the relevant economic parameters, many problems arise in choosing among alternative constructions that are reciprocally dependent and whose results are often significantly different. This problem of choice in regard to the construction, estimation and implications of the models, may be subdivided into many interrelated parts, each part containing several alternatives.

- (1) The choice and construction of the economic theory deemed relevant to the particular sector or sectors under study;
- (2) The selection of the variables to be included in the model and the make-up of each structural equation;
- (3) The classification of these variables on the basis of economic and statistical criteria;
- (4) The stochastic assumptions concerning the type of error found in the model;
- (5) The specific algebraic form of the equations;
- (6) The identification properties of the model and the method of estimation;
- (7) The type of data that will reflect the postulated variables, the degree of aggregation, the dimension of observation and its extent; and
- (8) The economic and statistical significance of the structural parameter estimates.

Each of these divisions offers at least two alternatives from which to choose and economic theory and observation can be used only as a qualitative aid in this choice. As many possible models arise as there are combinations of reasonable alternatives.<sup>1</sup> For any particular problem this diversity of possible choices can lead to a large number of parameter

\* The research on which this paper is based was conducted while the authors were on the staff at the University of Connecticut.

\*\* The authors gratefully acknowledge helpful comments and critical reviews of the manuscript from Professors L. F. Miller, J. S. Plaxico and R. L. Tontz of Oklahoma A. & M. College, J. A. Nordin and G. Tintner of Iowa State College and J. S. Tobin of Yale University. R. J. Foote of the Agricultural Marketing Service and K. A. Fox of the Council of Economic Advisors reviewed an earlier draft of the manuscript and offered valuable suggestions.

<sup>1</sup> The number of models possible will be somewhat less than the simple combinations of alternatives due to joint dependence among certain alternatives such as error assumptions and methods of estimation.

estimates, no two of which would necessarily be the same. Given these sets of admissible alternatives this paper is concerned with the impact of model choice upon the results of quantitative research in economic behavior equations. This problem is important since (1) any statistical inference regarding identifiable parameters is conditional upon the validity of the specification of the model and (2) most economic data are of a non-experimental nature and thus it is impossible to make data conform to a previously selected model.<sup>2</sup> Knowledge of the impact of omission or inclusion of relevant variables on the signs and values of the other coefficients in the model will do much to point up the importance of the specification or choice of the model, a less technical phase of the estimation process. The aim of this paper is to stress this controversy inherent in the specification of the model in economic parameter estimation, and to point up the practical and philosophical difficulties encountered when certain statistical methods are applied to concrete problems.

### *Choices Relating to the Model*

The building of economic models represents an attempt to reconstruct, in a simplified way, the mechanisms thought to lie behind the phenomena observed in the real world. As an aid in this task, modern economic theory, based on certain fundamental assumptions about maximization and the generation of economic variables, provides a foundation stone from which it is possible to make statistical inference apply directly to economic behavior equations that are most relevant to analysis and policy decisions. By then utilizing the tool of mathematics, alternative economic models can be derived and expressed as an equation or systems of equations. Although economic theory provides a comparatively detailed specification of a particular structure of the economy, there exists many competing sets of *a priori* restrictions that can be imposed upon the make-up of the structural equations without contradicting present knowledge of human behavior and environment. In other words, many plausible variants of the model are available. As viewed by Haavelmo, the building and choice of models is not a problem of pure logic, but of knowing something about real phenomena and making realistic assumptions about them.<sup>3</sup> Also there are many alternatives or choices as to how the theoretical structure or system may be closed and the precise way chosen by the investigator may influence the method of estimation utilized and the

<sup>2</sup> Discussions pertaining to this problem may be found in T. C. Koopmans "The Logic of Econometric Business Cycle Research," *Journal of Political Economy*, 49: 157-181, 1941, and "Identification Problems in Economic Model Construction," *Econometrica* 17:141-142, 1949.

<sup>3</sup> T. Haavelmo "The Probability Approach in Economics," *Supplement to Econometrica*, 12:29, 1944.

parameter estimates obtained.\* This is the problem of choice among several alternative hypotheses in regard to the exclusion or inclusion of certain variables in a particular equation or model.

### *Algebraic form*

Assuming that the investigator arrives at an acceptable solution for the variables entering each of the structural equations he is then confronted with choices relating to the many possible algebraic forms for the equations. Economic theory only specifies some very general properties of the functional form.<sup>5</sup> Only linear models, with variables expressed either in natural units or their logarithms appear statistically tractable. The investigator lacks an operational choice indicator between these two alternatives and must either choose one or estimate relations involving both.\*

### *Classification of variables*

Economic theory provides a basis for the classification of the variables appearing in the structural equations. Although precise economic definitions are given for the variables and there exists a statistical criterion by which a variable may be called exogenous if certain assumptions are met, the final classification is conditioned by the knowledge of the investigator about the generation of the variables and his assumptions. The choice that finally evolves is of paramount importance since it is imperative to know which variables are exogenous to the system and how these exogenous variables influence the endogenous variables of the model.<sup>7</sup> This choice effects the number of equations contained in the model, the parameter estimates and the method of estimation.

\* Richard Stone "Measurement of Consumers Behavior and Expenditures in the United Kingdom 1920-38," Cambridge University Press, London, I:295, 1954.

<sup>5</sup> The problem of choosing the algebraic form of the equations is not isolated to the estimation of behavior equations. It also occurs in estimating technical relationships and has been pointed up by Hildreth as follows: "while economists typically have rather firm judgments about some properties (e.g., diminishing returns to certain inputs, technical complementarity or substitution relations between certain pairs of inputs, etc.) of production functions, they are seldom sure that a particular form is appropriate. That this problem has significance is indicated by the fact that, where alternative assumptions about form have been explored, they have often had markedly different implications." C. Hildreth, "Economic Implications of Some Cotton Fertilizer Experiments" *Econometrica*, 23:88, 1955.

<sup>7</sup> The problems of nonlinear models have hardly been attacked and those of the identification properties of nonlinear models have never been solved. However, linear models (in natural or logarithmic units) may be considered good approximations around the means of the observations, but may not be suited for extrapolation. The poor results of forecasting by some of the Cowles Commission models that were derived from the interwar period may be explained by this difficulty.

<sup>8</sup> C. H. Orcutt, "Toward a Partial Redirection of Econometrics" with comments by T. C. Koopmans, J. Tinbergen and Nicholas Georgescu-Roegen, *The Review of Economics and Statistics*, 34:195-213, 1952.

### *Stochastic assumptions*

In order to use the tools of statistical inference, certain stochastic assumptions must be made about the postulated system of equations. Two types of assumptions appear useful. The errors may be viewed as attached to the variables (error of observation)<sup>8</sup> or attached to the equations that form the model (not including all of the variables suggested by economic theory in the equation—specification error).<sup>9</sup> Decisions to attach the error to this or that variable or equation does not in itself provide a sufficient basis for the choice of the statistical method. Something else must be said about the errors and restrictions must be imposed. Specific assumptions must be made about their distribution, dependence or independence, in order to make probability statements possible. The specification of the errors and their characteristics in the model thus has a large role in determining the method of estimation and the probability distribution of the endogenous variables.<sup>10</sup> Once again the investigator is faced with a choice.

### *Identification properties*

Once a logical set of choices has been made and the model has been constructed, the identification properties of the model or the relevant equations to be estimated must be investigated. The problem of identification involves ascertaining (1) if each mathematical equation represents a definite economic relation and (2) if the estimation of the structural parameters is possible.<sup>11</sup> The classification of the variables as endogenous, exogenous and predetermined makes possible a solution to the problem of identification. If the errors involved have been assumed to be those of incomplete specification, the number and array of exogenous and predetermined variables determine if estimation is possible and if so by what method. By employing the concept of identification, a sharper formulation and treatment of the choice of a model is made possible. However, the problem of choosing among postulated models that are

<sup>8</sup> T. Koopmans, "Linear Regression Analysis of Economic Time Series," *Harlem, Netherlands Economic Institute*, 1937, and G. Tintner, "Multiple Regression for Systems of Equations," *Econometrica* 14:4-35, 1946.

<sup>9</sup> T. Haavelmo, "The Statistical Implications of a System of Simultaneous Equations," *Econometrica* 11:1-12, 1943.

<sup>10</sup> To handle both errors in the equations and errors in the variables, Anderson and Hurwicz have considered general models concerning both simultaneously—however an operational model is not yet forthcoming. T. W. Anderson and L. Hurwicz, "Errors and Shocks in Economic Relationships," *Supplement to Econometrica*, 17:23-25, 1949.

<sup>11</sup> T. C. Koopmans, "Identification Problems in Economic Model Construction," *Econometrica*, 17:125-144, 1949.

*a priori* equally plausible still remains. No satisfactory statistical theory of choice among several alternative hypotheses is available.<sup>12</sup>

The usual testing by statistical theory considers only one hypothesis and its negation or two hypotheses at a time. This is inadequate when a number of hypotheses, classifiable according to a large number of attributes, are in competition. Koopmans has discussed the problem as follows—"if there are two variables whose exclusion either jointly or individually, from a given equation is not essential to its identifiability, it is possible to test separately (a) the exclusion of the first variable, (b) the second variable, or (c) both variables simultaneously, as against (d) the exclusion of neither variable. However, instead of three separate tests, of (a) against (d), (b) against (d) and (c) against (d), we need a procedure permitting the selection of one of the four alternatives (a), (b), (c), or (d). An extension of current theory with regard to the testing of hypotheses, which is concerned mainly with the choices between two alternatives, is therefore needed."<sup>13</sup>

### *Choice of data*

Having decided upon the model, its stochastic characteristics and its properties of identification, the next step is to choose data that will reflect the variables specified by the model. Two types of models appear in economic literature, microeconomic and macroeconomic. At first glance it appears quite hopeless to consider estimating a complete system of equations involving the variables of microeconomics. An alternative is to sacrifice this detailed information and develop systems of macroeconomic relations that involve a smaller number of variables.<sup>14</sup> Passing from the theories of microeconomics to those of macroeconomics, involves the difficult and largely unsolved problem of aggregation. The main tools of this transformation are index numbers and similar aggregates. There is no known best way in which the transition can be made from a microeconomic system involving millions of variables to a well defined macroeconomic system involving few so that the data that finally evolve will be subject to several types of error. Most of the data usually employed in econometric work are obtained from the records of government bureaus. The available economic time series are seldom in a form suitable for im-

<sup>12</sup> A recent theory by Carnap which used the concepts and methods of modern logistics may yet provide a possible solution to this question. R. Carnap: *Logical Foundations of Probability*, Chicago: The University of Chicago Press, 1950.

<sup>13</sup> T. C. Koopmans *op. cit.* p. 142.

<sup>14</sup> L. R. Klein, "Macro Economics and the Theory of Rational Behavior," *Econometrica* 14:98-108, 1946, and J. B. Balderston and T. M. Whitier, "Aggregation in the Input-Output Model" *Economic Activity Analysis* (Edited by O. Morgenstern), New York: John Wiley and Sons, 1954.

mediate use in econometric studies. In processing the data into a form suitable for the model, many assumptions (choices) and questionable steps are involved.<sup>15</sup> After the data have been obtained there then arises the question of whether the variables should be expressed in absolute or real terms. If they are to be used in real terms a question arises as to the appropriate deflator. Then the choice arises between time series or cross section data or both.<sup>16</sup> A choice of sample time period must be made. Also there are the problems of autocorrelation of the series, multicollinearity and errors of observations in the data.<sup>17</sup> Most of the methods of estimation currently employed do nothing to avoid these pitfalls. It should also be mentioned that statistical availability determines in part the variables that appear in the model. In many cases the data either are not available at all or are not available in the form that is necessary to reflect the variable or variables under consideration.

#### *Additional decisions*

Finally some "reasonable" model is constructed, the data are obtained and a method of estimation is chosen that best fits the assumptions of the model. However, many more decisions lie in wait. Among these are the economic and statistical significance of the parameter estimates and their interpretation. To insist on statistically significant estimates is clearly called for, but the present tendency to exclude results that seem inconsistent with the investigator's preconceptions of economic reality is a more dubious practice.

The research worker who has gone through the steps outlined in this section and who constructs such an economic model is usually well aware that the model, even if it were susceptible to precise measurement, may not describe reality. In many cases static models are applied to the dynamic situations of the real world from which the data are generated. Linearity and discrete time lags are at best only approximations. Also, as has been demonstrated, many sequences of choices are jointly open to the economic model builder. However, models are built by selecting the sequence of choices that are *a priori* most significant and it is at this

<sup>15</sup>An example, in the last part of this paper, of another kind of data problem is the index used to reflect the consumption of food. As many writers have pointed out, this index is a small economic system in itself.

<sup>16</sup>C. Hildreth has worked with both time series and cross section data in estimating the parameters of behavior quotations. Tobin in a study of the demand for food has utilized both types of data. J. Tobin, "Statistical Demand Function for Food in the U.S.A." *Journal of Royal Statistical Society, Series A*, CXIII 1951.

<sup>17</sup>For procedures dealing with autocorrelation, stochastic difference equations, etc. see G. Tintner, *Econometrica* New York: John Wiley and Sons, 1952, pp. 239-323, and H. Wold, *Demand Analysis* New York: John Wiley and Sons, 1953, pp. 28-60 and 149-179.

juncture that the art and judgement of the economic model builder are most acutely tested.

### *Empirical Examples*

In order to expose the nature of these purely qualitative judgements and to give an illustration of the possible effects of small model variations, the following example may prove helpful. It should certainly not be inferred from the results of these examples that these analyses are representative of the best that the profession and the data can provide. They are presented only as examples of what happened when certain models and methods were applied to the data of particular segments of our economy. However, in their role as examples it is hoped that the results will point up the impact of model specification upon the estimation of economic parameters and some dangers too often implicit in such studies.

In order to illustrate the importance of model specification the estimation problem, several models varying in size, variable classification and functional form are constructed in the fashion that several workers might investigate the same estimation problem. Special emphasis is directed toward the impact of the number and array of exogenous and predetermined variables in the model and the method of estimation on the resulting parameter estimates. As a vehicle for this testing, models of the aggregate demand for all food and for eggs are used.

The aggregate demand for all food affords a very simple model in this respect. The general model to be employed is similar in size and structure to the one used by Girshick and Haavelmo in their study of the demand for food.<sup>18</sup> Because of space limitations we shall not discuss the logic behind the selection and specification of the variables in each of the linear stochastic equations. The model will specify only the arrangement of the variables, their identity and classification. The letter  $Y_t$  will denote an endogenous variable,  $Z_t$  an exogenous or predetermined variable and  $U_t$  a normally distributed random disturbance, each variable observed over a time vector  $t$ .

#### *Retail demand for food*

$$B_{11}Y_{1t} + B_{12}Y_{2t} + B_{13}Y_{3t} + A_{11}Z_{1t} = U_{1t} \quad (1.1)$$

Where  $Y_{1t}$  represents the per capita retail consumption of food,  $Y_{2t}$  the retail price of food,  $Y_{3t}$  per capita disposable income,  $Z_1$  represents  $Y_s(t-1)$ , that is  $Y_{3t}$  with a one year lag, and  $U_{1t}$  the residual error of the first equation.

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<sup>18</sup> M. A. Girshick and T. Haavelmo, "Statistical Analysis of the Demand for Food: Examples of Simultaneous Estimation of Structural Equations," *Econometrica*, 14: 79-110, 1947.

*Retail supply of food*

$$B_n Y_{1t} + B_n Y_{2t} + B_n Y_{4t} + A_n Z_{st} = U_{st} \quad (1.2)$$

where  $Y_4$  represents the per capita supply of food by farmers and  $Z_3$  prices in the export market.

*Demand for food at the farm*

$$B_n Y_{1t} + B_n Y_{2t} + B_n Y_{4t} + B_n Y_{5t} + A_n Z_{st} + A_n Z_{4t} = U_{st} \quad (1.3)$$

where  $Y_5$  represents the price received by farmers for food and  $Z_4$  the marketing margin.

*Farm supply of food*

$$B_n Y_{1t} + B_n Y_{2t} + A_n Z_{st} + A_n Z_{5t} + A_n Z_{6t} + A_n Z_{8t} = U_{st} \quad (1.4)$$

where  $Z_5$  is  $Y_{5(t-1)}$ , that is  $Y_5$  with a one year lag,  $Z_6$  firm's factor cost, and  $Z_8$  weather.

*Income generation*

$$B_n Y_{1t} + A_n Z_{st} + A_n Z_{10t} = U_{st} \quad (1.5)$$

where  $Z_9$  is per capital net investment.

Thus, the set of hypotheses that constitutes the structural equations of the general model for all food products in aggregate, consist of five linear stochastic equations that explain the generation of the five endogenous variables. From this system of equations, attention is directed toward the estimation of the parameters of demand equation (1.1).

*The postulated model*

The postulated model illustrates the magnitude of simplification from the general equilibrium model. Although the assumptions reduce the postulated model to a simplified version of reality, gains accrue in terms of clarity and manageability, and details that are presumed to be insignificant are eliminated without destroying the basic underlying structural relationships. But this model is a deliberate and arbitrary simplification of a more complete set of variables. A criterion of choice used for the process of simplification is that the exogenous and predetermined variables chosen are highly correlated with the endogenous variables and possess low correlations with each other. Such a criterion conforms to the assumptions made in variable classification although it is not logically sufficient. On this basis, the variable  $Z_2$  which is a time or trend variable,  $Z_7$  a lagged firms factor cost, and  $Z_{10}$  representing lagged per capita consumption of food, were deleted from the operational model linear in natural units. Yet the ten chosen were only a fraction of the complex of known and unknown relevant exogenous variables.

In order to assess the impact of the specification of the number and array of predetermined variables in the model on the parameter estimates,

several models containing a smaller number of exogenous and predetermined variables were constructed.<sup>19</sup> The choice of the deleted variables in these smaller models was based on their degree of correlation with the remainder of the predetermined variables and their degree of importance (judged by *a priori* knowledge about the economic relations) in influencing the endogenous variables of the system. Although many details of economic behavior are not included in these smaller models, they are valuable in screening multiple possibilities among a group of admissible hypotheses. As a further basis of comparison uni-equational models of demand were constructed with price and consumption alternately considered as the dependent variable.

#### *Choice of data and algebraic form of the equations*

Although the choice of data must be made before the model is simplified by the intercorrelation criterion, the two really go together since different associations would result from different types of data. Published aggregative data from the records of government bureaus were chosen and a system was developed from these data. All price or cost variables are expressed in real terms (deflated by the cost of living index). The sample of observations was over the time dimension for the period 1921-52 (excluding the war years 1942-46 inclusive). For reasons previously stated, the algebraic form of the equations was assumed linear in natural units or common logarithms and certain models were estimated using both of these functional forms.

#### *Error assumptions and identification*

The methods that error assumptions delineate and the statistical properties of their estimates have been well summarized by Kuznets in a recent paper.<sup>20</sup> The assumptions chosen were those of incomplete variable specification with a resulting shock model. The observed data were assumed (1) to accurately reflect the postulated variables and (2) to be measured without error since the only errors considered were those in the equations. This decision is difficult since economic theory does not, as yet, allow for errors that the quantitative researcher encounters.

According to generally accepted criteria,<sup>21</sup> equation 1.1 is overidentified and the limited information method of estimation developed by Anderson and Rubin is applicable.<sup>22</sup> For the smaller models enough variables were

<sup>19</sup> The make-up of these models will be given when the results are presented.

<sup>20</sup> G. M. Kuznets, "Measurement of Market Demand with Particular Reference to Consumer Demand for Food," *Journal of Farm Economics*, 35:878-895, 1953 (Proceedings Number).

<sup>21</sup> T. C. Koopmans, "Identification Problems in Economic Model Construction," *Econometrica*, Vol. 17, 1949, pp. 184-35.

<sup>22</sup> For equation (1.1) identification is achieved, at least according to our classification

deleted to make equation (1.1) just identified. When an equation within a linear model is just identified, it is simple to pass from the estimated parameters of the reduced forms to the estimated parameters of the structural equations. In practice, identification criteria force the investigator to build identifiable models, although theoretical preconceptions are sometimes molded by the desire to estimate the relationships with a minimum of effort. Although the criteria impose restrictions on the estimation of the model, there are several alternative ways these can be met.

### *The empirical results*

The number of possible plausible variants of the model that a researcher may want to estimate are also strictly limited by time. The assumptions in summary are (1) that the data accurately reflect the variables, (2) that the error assumptions are the closest possible to reality, (3) that the theory underlying the model is adequate and (4) that an "ideal" model would not contain any more variables than those listed. The impact of the model in the measurement of the parameters of the demand for food will then be presented on the basis of varying in the functional form between linear in the observed and linear in logarithms, of some possible reduced form models and single equations of varied content and dependent variable assumptions. The parameter estimates quoted will be in the form of elasticities at the mean for arithmetic functions and constant elasticities for the logarithmic functions. The results are presented for comparison in Table I.

### *Comparison of the results<sup>23</sup>*

The point estimates obtained from the over-identified models (equations 2.1 and 2.2) for the demand for food appear reasonable and the signs of the parameters consistent with the micro theory of consumer choice. However, the magnitudes of the parameter estimates of the similar models

of the different variables in the system as to whether they should be endogenous, predetermined or reflected in the disturbance variable, and by specification of which variables enter into each structural equation. The statistical procedures for estimating a single equation in a complete system of linear stochastic equations are given in two articles by T. W. Anderson and H. Rubin, "Estimation of the Parameters of a Single Equation in a Complete System of Stochastic Equations," *The Annals of Mathematical Statistics*, 20:46-63, 1949; and "The Asymptotic Properties of Estimates of the Parameters of a Single Equation in a Complete System of Stochastic Equations," *The Annals of Mathematical Statistics*, 21:570-82, 1950.

<sup>23</sup> Standard errors of the parameter estimates are not given. To be sure the use of an estimate is greatly restricted if not accompanied by a probability statement. However, for a large part only asymptotic standard errors are available and all standard errors are based upon the assumption of underlying normal distributions of the random disturbances, which may not always be justified. Thus, for this discussion, we have chosen to use only point estimates for the parameters estimated.

differ. In equation 2.1 the effect of current income is about twice as great as that of last year's income. In equation 2.2 current and lagged income have about the same estimated effect. When the over-identified models

TABLE I. THE IMPACT OF VARIOUS MODELS AND METHODS ON THE PARAMETER ESTIMATES OF PRICE AND INCOME ELASTICITIES OF UNITED STATES RETAIL FOOD DEMAND USING 1921-41, 1947-52 TIME SERIES DATA

Equation	Method	Functional form	Equation content	Model assumptions	Elasticity parameter estimates
					Price Income Lagged income
2.1 <sup>a</sup>	Limited Information	Natural Units	$y_1, y_2, y_3, z_1$	$x_1, x_2, x_3, x_4, x_5$	-0.138 0.170 0.087
2.2	"	Logarithms	$y_1, y_2, y_3, z_1$	$x_1, x_2, x_3, x_4, x_5$	-0.110 0.127 0.125
2.3	Reduced Form	Natural Units	$y_1, y_2, y_3$	$x_2, x_3$	-0.113 0.243 —
2.4	"	"	$y_1, y_2, y_3, z_1$	$x_1, x_2$	0.020 0.168 —
2.5	"	"	$y_1, y_2, y_3, z_1$	$x_2, x_3$	-0.654 0.920 0.222
2.6	"	"	$y_1, y_2, y_3, z_1, z_2$	$x_2, x_3$	0.273 0.107 0.045
2.7	"	"	$y_1, y_2, y_3, z_1$	$x_2, x_3$	-0.103 0.170 0.072
2.8	"	"	$y_1, y_2, y_3, z_1$	$x_2, x_3$	-0.223 0.180 0.109
2.9	"	"	$y_1, y_2, y_3, z_1$	$x_2, x_3$	-0.145 0.177 0.088
2.10	Single Equation	"	$y_1, y_2$	$y_1$ dependent	0.418 <sup>b</sup> — —
2.11	"	"	$y_1, y_2, y_3$	$y_1$ dependent	-0.123 0.253 <sup>b</sup> —
2.12	"	"	$y_1, y_2, y_3, z_1$	$y_1$ dependent	-0.142 <sup>b</sup> 0.210 <sup>b</sup> 0.050
2.13	"	"	$y_1, y_2, y_3, z_1, z_2$	$y_1$ dependent	-0.186 <sup>b</sup> 0.237 <sup>b</sup> 0.064
2.14	"	"	$y_1, y_2, y_3, z_1$	$y_1$ dependent	-0.698 <sup>b</sup> 0.323 <sup>b</sup> 0.147
2.15	"	Logarithms	$y_1, y_2, y_3$	$y_1$ dependent	-0.112 0.256 <sup>b</sup> —
2.16	"	"	$y_1, y_2, y_3, z_1$	$y_1$ dependent	-0.130 <sup>b</sup> 0.213 <sup>b</sup> 0.058
2.17	"	"	$y_1, y_2, y_3, z_1, z_2$	$y_1$ dependent	-0.129 0.215 <sup>b</sup> 0.058

<sup>a</sup> Predetermined variables appearing in the model but outside of the equation to be estimated (2.1 through 2.9)

<sup>b</sup> The results of the model for equation 1 were upheld when subjected to the autocorrelation test of the disturbances and the largest characteristic root test for overidentifying restrictions. Equations 2.9 and 2.12 were also upheld by the autocorrelation test of the disturbances.

<sup>c</sup> These coefficients were statistically significant at or above the 95% probability level.

are compared with the reduced form models several differences in the parameter estimates are apparent. Although a change of three variables in the model is by no means trivial the magnitude of discrepancies among these models is nevertheless substantial. When the just-identified parameter estimates are reviewed they are seen to be sensitive to the addition or deletion of certain predetermined variables in the remainder of the system, e.g., depending on the choice of the predetermined variables, the price elasticity estimate varied from -0.654 to 0.273. Current and lagged income elasticity estimates vary in respect to absolute magnitude and in relation to each other. This as a result, changes in the parameter estimates of the demand relationship occurred when the specification of one predetermined variable appearing in another *theoretically autonomous* equation was altered. In the single equation estimates, various parameter estimates are obtained depending upon the make-up of the equation and assumptions of dependency. In these models current income appears to have about four times the effect of lagged income. If equation (2.12) is chosen from the single equation estimates, a one standard error band about the coefficients contains the parameter estimates of the overidentified equations. One must keep in mind, however, that the choice of consumption as the dependent variable in least squares fitting is not unique.

When price was selected as the dependent variable a price elasticity estimate of -0.70 was obtained.

In testing the results for external consistency, observations partially or completely outside of the sample period can be used to ascertain the adequacy of these equations for prediction purposes. Percentage prediction errors were obtained for each endogenous variable whose course over time is to be explained. This test revealed little basis of choice between the methods and models. Each appeared to do a creditable job and the maximum error of prediction for any year was 1.7 percent.

Estimating the parameters of the demand equation for food has provided a vehicle for many statistical studies. The results quoted by Kuznets show a range of discrepancy of -0.81 to -0.20 for the elasticity of retail demand with respect to price using data comparable with those used in this study.<sup>27</sup> From the estimates cited by Kuznets, it appears to have been generally accepted that the elasticity of demand for food at retail was about -0.25 in the 1921-41 sample period. By the addition of six post-war years, 1947-1952, point estimates were derived that suggest a decreasing trend for this parameter. Among the many models computed, and on the basis of the estimates that pass the statistical tests of significance, nonautocorrelation and, where applicable, the overidentifying test of restrictions, the resulting estimates suggest that the elasticity of retail demand for all food with respect to price may be between -0.15 and -0.10.<sup>28</sup> The mean of all the quoted estimates was -0.14, and the mean of all the estimates except those known to be statistically unacceptable was -0.13. It is interesting to note that the single equation estimate (2.12) is very close to that of the limited information estimate (2.1), both having similar composition. This would be even more comforting if some basis could be established *a priori* for choosing consumption as dependent rather than price as in (2.16). Then the more simple single equation technique might be applied, to an identifiable equation of a structural model.

#### A second model

A study dealing with the demand for eggs is presented as a second example.<sup>29</sup> The structural economic relationships constituting the model

<sup>27</sup> G. M. Kuznet, *op. cit.*, p. 882.

<sup>28</sup> It should, however, be noted that these are point estimates and when the standard errors of the estimated parameters are considered the difference between the two sets of estimates are not significant at the 5 per cent probability level. In addition it may be questionable as to whether or not the 1947-49 observations should have been included in the sample period since these observations are disturbed by such factors as high liquid assets holdings of consumers and shortages of consumer durable goods.

<sup>29</sup> G. G. Judge, *Econometric Analysis of the Demand and Supply Relationships for Eggs*, Conn. Agr. Expt. Sta. Bulletin 307, 1954.

for the egg market sector of the economy are in the form of a system of twelve linear stochastic equations. This model comprised a complete system of equations that contains 12 endogenous, 10 exogenous or predetermined variables, and 12 random residuals or disturbances. The demand equation to be estimated contained 4 endogenous and 3 predetermined variables. By omitting 4 predetermined variables contained in the general model a demand equation was obtained that was just identified. The models constructed were of the shock type and observable time series data were used for the sample period 1921-41. The equations were linear in the logarithms of the observed variables and resulted in the following parameter elasticity estimates for eggs:

over identified

$$y_1 = -0.58 y_2 + 0.60 y_3 - 0.49 y_4 + 0.44 z_1 + 0.29 z_2 - 0.29 z_3 + 1.71,$$

just identified

$$y_1 = -0.30 y_2 - 0.51 y_3 + 0.23 y_4 + 0.35 z_1 + 0.31 z_2 - 0.03 z_3 + 1.87,$$

where  $y_1$  is the per capita consumption of eggs,  $y_2$  retail price of eggs,  $y_3$  retail price of meats,  $y_4$  retail price of other foods,  $z_1$  income,  $z_2$  lagged income, and  $z_3$  time. The limited-information equation of demand yielded a retail price elasticity for eggs of -0.58, while -0.30 was obtained for the reduced form estimates. The demand for meat and eggs appears to be competitive in the limited-information and complementary according to the reduced form estimates. The current and lagged income elasticities also differ as to magnitude. Each of the equations predict a subsequent time period about equally well and the models were upheld when subjected to the autocorrelation test of the disturbances.

### Conclusions

Although the results presented should be considered of limited scope and significance they are of little comfort to the economic statistician engaged in the specification and estimation of economic models. Such results focus attention upon the problem of model specification and help to make explicit the degree of arbitrariness inherent in the specification of equation systems constructed to describe economic behavior. If the practical purpose of quantitative economics is to be able to forecast the economic results of policy decisions with a certain degree of probability, in order to lay before those responsible for choice the consequences of alternative courses of policy action, there is cause for concern. Certainly, policy based on one equation would be expected to produce actions different from a policy based on the choice of another equation whose parameter estimates differed. The researcher usually is unable to make any final and invariant statement as to the choice of model and methods of estimation and finds himself in a plight similar to that described so aptly

by the late Henry Schultz.<sup>20</sup> ". . . we cannot conveniently say to the legislator, 'your tariff will have one effect if the elasticity of demand is computed from the regression of price on quantity and quite a different effect if its derived from the regression of quantity on price.'" The simultaneous equation methods have at least helped to resolve the dependent variable choice. If economic preconception is used to test the signs of the parameter estimates, a rejection on this basis might well direct suspicion to the usefulness and accuracy of parameter estimates that "happen" to come out of the computations with what is considered conceptually to be the correct signs.

The problem of model building remains unsolved. The reduction of general models to a workable size presents a problem of choice among multiple hypotheses, conditioned by the interrelated restrictions of theory, methods and data. There appears to be no unique way of constructing equation systems to describe economic behavior. An arbitrariness appears in any system that is set down because of our limited knowledge of the dynamic mechanisms at work. In addition the sample data usually employed are consistent with a host of hypotheses. Several methods of estimation are available, but their validity of application is dependent upon a complex set of assumptions. A mixture of logic and intuition can narrow the range of admissible hypotheses but the final test of validity is a *pragmatic* one: Does the model yield results statistically significant and compatible with economic reality? The research worker concerned with economic measurement needs more assurance that economic theory can allow for the random element in economic behavior, that the subjectivity of choice between alternative models can be reduced, and that accurate data can be made available. In this interdependent compromise between economic and statistical assumptions, manageability and realism, data and inference, there is little to warrant overconfidence in the estimates of economic parameters but much opportunity for econometric research.

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<sup>20</sup> H. Schultz, "*The Theory and Measurement of Demand*," Chicago: The University Press, 1938, p. 148.

## ESTIMATING YIELDS AND GRADES OF SLAUGHTER STEERS AND HEIFERS<sup>1</sup>

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AT THE present time slaughter livestock are usually sold on the basis of estimates of live weight and grade. Questions are often raised about the pricing efficiency of this practice. Pricing efficiency is concerned with the price system accurately reflecting the final product value to the producer. If these product values are reflected accurately in terms of price, producers will have better guides for allocating productive resources to their appropriate use.

Pricing accuracy in livestock marketing is approached when the values realized by processors from the individual animals or lots of animals are fairly reflected to the producers. Farmers will then be encouraged to produce the proportion of the different weights and grades of animals that will maximize the consumer's satisfaction from the resources employed in livestock production. Pricing efficiency is concerned with directing the use of resources among producers.

Operational efficiency, on the other hand, is concerned with the use of capital, labor and management within and among the firms engaged in marketing livestock and their products. Operational efficiency in part refers to the effectiveness of the operations of the firms engaged in processing and distributing meat animal products. One of the objectives of these firms is making a profit.

Operational efficiency and pricing efficiency are not independent of each other. Although in many cases these two types of efficiency complement each other, at times they may be in direct conflict. When this conflict occurs this raises problems in the marketing system that warrant discussion.

A firm may adopt two types of programs to maximize its profits—one, to increase the demand for its products and the other to lower its cost curve. Most firms attempt to do both at the same time. These efforts tend to improve operational efficiency. If, in addition, there is an improvement

<sup>1</sup> Journal paper No. J-2837 of the Iowa Agricultural Experiment Station, Ames, Iowa, Projects 113 and 1219. The research reported in this paper was supported in part by North Central regional funds under NC project No. NCM-3.

<sup>2</sup> Statistical Laboratory and Department of Economics and Sociology, respectively, Iowa State College, under the guidance and supervision of the Members of the North Central Livestock Marketing Research Committee. The committee wishes to express its sincere appreciation to the packing company which generously contributed time and facilities to make this study possible. (Dr. Clifton is now with John Morrell and Co., Ottumwa, Iowa.)

in pricing efficiency by the individual firm, the marketing system is improved still more.

Innovations that do not improve the operational efficiency may not offer an immediate economic incentive for their adoption, even though they improve pricing efficiency. Such factors as "good will" and "public responsibility," however, may help induce firms to adopt pricing efficiency innovations that do not affect operational efficiency too adversely.

This paper deals only with the pricing accuracy aspect of the marketing system for slaughter steers and heifers. Questions that are considered include the following:

- (1) Are buyers' estimates of grades and yields accurate?
- (2) Does the buyer tend to estimate the yields of the different animals with equal accuracy?
- (3) Are the errors in estimating yield and grade related and can these errors be measured in suitable terms independent of prices?
- (4) Can the errors in estimating yield and grade be used to measure "errors in value"?

### *The Data*

The data actually used in this paper for presentation purposes consist of the individual yields (carcass weight expressed as percent of live weight) and live grades as estimated by one buyer for 219 steers and 74 heifers.<sup>3</sup> Associated data collected were the actual yield and carcass grade of each animal. The buyer's yield estimates were made and recorded to the nearest 0.5 percent. The grade was estimated and recorded to the nearest one-third of a grade. The grades were coded as follows:

Prime	top %	15
	middle %	14
	lower %	13
Choice	top %	12
	middle %	11
	lower %	10
Utility	top %	3
	middle %	2
	lower %	1

### *Limitations of the Data*

Before proceeding with the analysis, it seems necessary to point out some of the specific limitations of the data. First, the data analyzed con-

<sup>3</sup>This paper presents a further statistical treatment of some of the data appearing in a previous report. See *Accuracy of Pricing Slaughter Cattle, Veal Calves and Lambs*, North Central Publication No. 93, Purdue University, Indiana, 1955. These data were first reported in Minnesota Tech. Bul. 181, *Marketing Slaughter Cattle by Carcass Weight and Grade*, Feb. 1949.

sist of the estimates from a single buyer. No claim can be made that this buyer represents any population of buyers. Secondly, the animals used in the experiment may not adequately describe this specific buyer.<sup>4</sup>

A third limitation is the acceptance of the federal carcass grade as the final determinant of value. Other graders might have graded the carcasses differently such that any divergence between the federal carcass grade and the estimated grade might be smaller or larger than actually observed for this one buyer. A study of the variance of different graders in estimating the carcass grades of the same carcasses would be useful in assessing this limitation. A technical limitation is the fact that the arbitrary codes assigned to the federal grades may not properly reflect the nature of the variation within grades and among grades. As used these codes assume a certain uniformity of variation. The authors doubt the validity of this assumption and believe that there is usually more variation in the commercial or utility grades than within the choice or good grades.

Despite these limitations, the analysis of the data is presented in order to indicate an approach to the questions raised at the beginning of this paper. More important, however, the methodology employed may help other researchers in examining similar types of data.

### *Yield Errors*

The first step in the analysis was to examine the errors made in estimating yields. Since there is some possibility that buyers may estimate steer and heifer yields differently, analyses were first made separately and then combined.

#### *Steers*

For steers the average actual yield was 58.65 percent while the average estimated yield was 58.59 percent (Table 1).<sup>5</sup> This small difference in the means was not significant (Table 2).<sup>6</sup> This indicates that there was no bias on the average in the estimates of steer yields made by this buyer.

Even if there is no bias on the average for all animals, the buyer could overestimate the yield of some animals and underestimate others. It is important to the individual selling one or a few animals to know how

<sup>4</sup> Statistical inferences made in this paper are based on the assumption, however, that the data comprise a random sample of estimates from this buyer.

<sup>5</sup> See appendix for statistical tables and coefficients.

<sup>6</sup> This means that, if average estimated yields equal average actual yields, in repeated sampling from these populations the observed difference can be explained by reasonable sampling fluctuations. Specifically in this case, a difference of .06% or larger could be expected about 70% of the time if the true difference was zero. The rather conservative significance level of 1% is used throughout this paper.

TABLE 1. SUMMARY OF ANALYSIS OF REGRESSION OF ACTUAL YIELDS (OR GRADES) ON ESTIMATED YIELDS (OR GRADES)

Item measured or computed	Yield			Grade		
	Number of animals:			Number of animals:		
	Steers 219	Heifers 74	Steers and heifers 293	Steers 219	Heifers 74	Steers and heifers 293
Buyers' estimates:						
Mean	58.59	56.26	58.00	11.68	9.97	11.25
Standard deviation	3.00	2.33	3.00	2.14	2.14	2.26
Actual:						
Mean	58.65	56.80	58.18	11.20	10.19	10.95
Standard deviation	2.92	2.64	2.96	2.03	1.57	1.97
Correlation (actual with estimated)	0.80	0.76	0.80	0.88	0.84	0.87
Regression coefficient (actual on estimated)	0.78	0.87	0.80	0.84	0.61	0.78
Total S.S. (actual)*	1860	510	2559	899	179	1135
Reduction S.S. due to regression*	1198	298	1693	700	125	864
Deviation from regression S.S.*	662	212	876	199	54	271
Variance of estimate, $s^2_{y-x}$	3.05	2.95	3.02	0.92	0.75	0.93
Standard error of estimate	1.75	1.73	1.74	0.96	0.86	0.96
Standard error of regression coefficient	0.039	0.087	0.034	0.030	0.047	0.025
Student's $ t $ value for test of the hypothesis: $B=1$	5.64**	1.50	5.90**	5.25**	8.32**	9.68**

\* S.S.=Sum of squares. For Total S.S. correction for mean has been applied.

\*\* These values in this row have  $P < .001$ .TABLE 2. SUMMARY OF ANALYSIS OF YIELD AND GRADE ERRORS  
(ERROR = (ACTUAL - ESTIMATED) FOR YIELD OR GRADE)

Item measured or computed	Number of animals:		
	Steers 219	Heifers 74	Steers and heifers 293
<b>Yield:</b>			
Mean error	-.0534	-.5490	-.1785
Standard deviation	1.8623	1.7330	1.8400
Standard error of the mean	0.1258	0.2061	0.1075
Student's $t$ value for test of hypothesis: true mean error = 0			
	0.42	2.66*	1.66
<b>Grade:</b>			
Mean error	+.4749	-.2160	+.3003
Standard deviation	1.0196	1.1970	1.1066
Standard error of the mean	.0689	0.1391	0.0646
Student's $t$ value for test of hypothesis: true mean error = 0			
	6.89*	1.55	4.65*
Correlation: yield and grade errors**	+.242	+.221	+.257

\*  $P(|t| \geq t_{obs}) \leq .01$  where  $t_{obs}$  is figure given in table.\*\* These observed values would be judged significant at the 1% level if  $(y_A - y_E)$  and  $(G_A - G_E)$  could be considered bivariate normal. Since  $G_A$  and  $G_E$  are discrete the test of the hypothesis  $\rho=0$  can only be approximate. We have chosen to accept the observed values as indicative of some degree of correlation.

much he may overestimate or underestimate individual animals. Further, it is important to the feeder who habitually markets cattle of certain qualities. To determine whether or not there was a bias in estimating certain yields, the linear regression of the actual yield on the estimated yield was computed. The estimated regression coefficient was 0.78. If the actual and estimated yields were identical, this coefficient would be

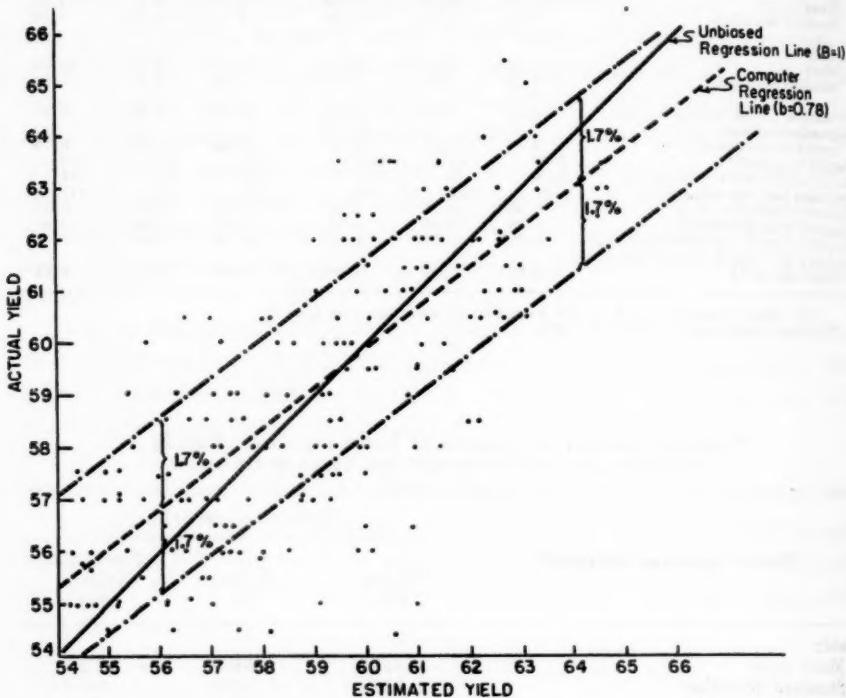


FIG. 1. UNBIASED REGRESSION LINE COMPARED WITH COMPUTED REGRESSION LINE FOR ONE BUYER'S YIELD ESTIMATES FOR 219 STEERS.

1.0. Thus, the difference between the estimated coefficient and 1.0 becomes important. A test indicated that the estimated regression coefficient differed significantly from 1.0 (Table 1). Since the linear regression line passes through  $(\bar{x}, \bar{y})$ , this means that on the average the buyer underestimated the lower yielding animals and overestimated the higher yielding ones (note that the means did not differ significantly). These results are shown in Figure 1.<sup>1</sup>

<sup>1</sup> The question might be raised as to how this regression should be computed. As indicated we have chosen to compute the regression of actual yield on estimated yield. Both variables are subject to error, but errors may be expected to be smaller for actual yield. In practice what would be wanted, however, is a regression equation for correcting the buyer's yield or grade estimates. Hence, the estimated yields or grades after they have been obtained may be taken as the fixed  $x$  values of

The computed regression line is above the unbiased regression line ( $B = 1.0$ ) when the yields are less than the mean, indicating that these yields were underestimated. Similarly, the yields of those animals that yielded more than the average were overestimated.

About 64 percent of the variation in the actual yields was linearly associated with the estimated yield while 36 percent was unexplained (Table 1). The standard error of estimate was about 1.75 percent. This indicates that the buyer would have overestimated or underestimated the yields of approximately one-third of the animals by 1.7 percent or more if the observed regression were used to correct the errors in the buyers' estimates. This is shown by the points in the area outside of the parallel lines 1.7 percent either side of the computed regression line in Figure 1. However, the standard deviation of the buyer's errors in estimating the actual yields was 1.86.<sup>8</sup> Had the buyer used the regression estimate, he could have reduced this error from 1.86 to 1.75. This may be expressed as a 13% gain in efficiency or reduction of variance by use of the regression correction procedure.

#### *Heifers*

For heifers the yield estimates were quite similar to those for steers. The average actual yield was 56.80 while the average estimated yield was 56.26 (Table 1). This difference, though small, tested significant, i.e., could not be attributed to reasonable sampling fluctuations; hence, we conclude that there was a slight bias in favor of underestimating the average yield of heifers (Table 2).

A regression analysis as already described for steers was completed for the heifer data. The regression coefficient was 0.87. A test indicated that this coefficient did not differ significantly from 1.0 (Table 1). Thus, the bias tendencies exhibited by the buyer in determining steer yields were less marked for heifers. The standard error of estimate was the same as the value obtained from the steers (1.7).

#### *Steers and heifers combined*

To examine the regression homogeneity of the yield estimates of steers and heifers, a pooled regression was computed and the significance of the reduction of the error sum of squares by using individual regressions

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classical regression theory and a correction equation estimated from the available data. The grade situation, however, is less satisfactory than the yield case. The grade variables are discrete; there are only 15 possible values for estimated grade and actual grade.

<sup>8</sup> Note our later remarks on the regression problem. This method of measuring the buyer's errors also assumes a regression, i.e., the unbiased regression with  $B = 1$ , which has already been mentioned. Thus, taking deviations  $(y_A - y_B)$  is equivalent to  $(y_A - B y_B)$  if  $B = 1$ , where  $y_A$  and  $y_B$  are actual and estimated yields.

was tested (Table 3). The difference (.78-.87) between regression coefficients was not found to be significant. This leads to the conclusion that for this buyer the errors over the observed range of yields were similar for steers and heifers, and that the slopes of the two regression lines, 0.78 and 0.87, may well be averaged to give the weighted figure, 0.795.

TABLE 3. ANALYSES OF VARIANCE FOR REGRESSION OF ACTUAL ON ESTIMATED VALUES FOR YIELDS AND GRADES OF 293 STEERS AND HEIFERS

Source of variation	Degrees of freedom	Sums of squares	Mean square
<b>Yield Analysis</b>			
Total	292	2559	—
Deviations from pooled regressions	291	876	—
Deviations from individual regressions	290	874	3.00
Difference	1	2	2.00
$F = 2.00/3.00 = 0.67$ (1; 290 degrees of freedom) not significant at 5% level.			
<b>Grade Analysis</b>			
Total	292	1135	—
Deviations from pooled regressions	291	271	—
Deviations from individual regressions	290	253	0.87
Difference	1	18	18.00
$F = 18.00/0.87 = 20.7$ (1; 290 degrees of freedom) significant at the 1% level.*			

\* Since the grade variable is discrete this test is only of approximate validity.

### Grade Errors

The same procedure was followed to analyze the grade estimates.

#### Steers

The average actual grade of the steers was 11.2 compared with an estimated grade of 11.7 (Table 1). This difference between means is significant. Since the estimated mean was greater than the actual mean, the buyer had a tendency to overestimate the average grade of the steers (Table 2).

The regression coefficient of actual on the estimated grade was 0.78. This value for the slope of the regression was significantly less than one. Since the means were significantly different and the regression coefficient was also significantly different from one, it is of interest to examine these relationships visually. Figure 2 is constructed by using actual grade on the y axis and estimated grade on the x axis. The unbiased regression line does not pass through the mean of y (11.2) and the mean of x (11.7). The computed regression line crosses the unbiased regression line ( $B = 1$ ) to the left of the mean of x. This means that the buyer tended to underestimate the grades of the steers to point c and then overestimate the grade of those to the right of point c. So here again one finds this buyer

underestimating the lower grades and overestimating the higher grades. The standard error of estimate was about 1.0 coded grade. Thus, we would expect the buyer to overestimate the grade by this amount or more about one-third of the time.

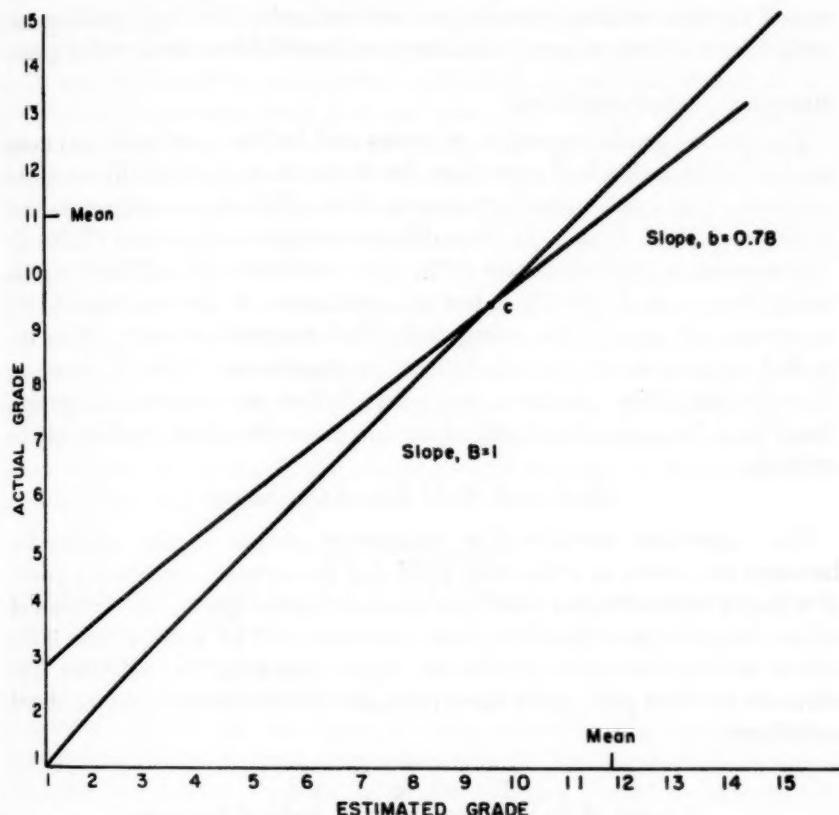


FIG. 2. COMPARISON OF UNBIASED ESTIMATION OF GRADE WITH OBSERVED REGRESSION OF ACTUAL GRADE ON ESTIMATED GRADE FOR 219 STEERS.

### Heifers

The average estimated grade for heifers was 9.97 while the actual grade was 10.19 (Table 1). This difference (although in the opposite direction from that for the steers) could be explained by sampling variations (Table 1). That is, the hypothesis that the buyer estimated the grades correctly on the average is accepted. Thus, we observe that the buyer had a real tendency to overestimate the average grade of steers but did not have the same tendency when estimating the average grades of heifers.

The regression coefficient of actual grade on estimated grade was 0.611 (Table 1). This regression is significantly different from  $B = 1$ . Thus, it appears that the buyer had a bias in estimating the average grade for animals differing in grade from those in the neighborhood of point c, Figure 2. When estimating the grades of heifers, the buyer underestimated the low grading animals and overestimated the high grading animals. The standard error of estimate was about 0.90 units of coded grade.

### *Steers and heifers combined*

The pooled grade regression of steers and heifers combined was quite similar to the individual regression for steers since it is heavily weighted by steers. The mean actual grade was 10.95 while the average estimated grade was 11.25 (Table 1). The difference tested significant (Table 2). The regression coefficient was 0.76. This coefficient also differed significantly from one (Table 1). A test of significance of the reduction in the error sum of squares by using individual regressions rather than the pooled regression was found statistically significant (Table 3). Even so, since buyers often purchase steers and heifers in combination groups, there may be economic justification for presenting this pooling of the estimates.

### *Grade and Yield Errors Combined*

One important consideration mentioned earlier is the relationship between the errors in estimating yield and the errors in estimating grade. If a buyer overestimates yield but underestimates grade, the variance of errors in grade plus errors in yield estimates will be smaller than if the errors in both estimates are in the same direction. i.e., additive. The variance of yield plus grade error estimates of the animals may be stated as follows:

$$\sigma^2 = \sigma_T^2 + \sigma_y^2 + 2\rho_{T,y} \sigma_T \sigma_y$$

$\sigma_T^2$  = sum of the variances (yield plus grade) of the errors

$\sigma_y^2$  = variance of yield errors (actual-estimated)

$\sigma_g^2$  = variance of grade errors (actual-estimated)

$\rho_{T,y}$  = correlation coefficient of yield errors with grade errors

Estimates of  $\sigma_T^2$  and  $\sigma_g^2$  may be obtained from the standard deviations reported in Table 2. The next step is to evaluate the covariance term. This can be done by computing the correlation of the yield errors and the grade errors. These results were obtained for steers and heifers individually and then pooled.

For steers the correlation coefficient of the error of yield with the error of grade was +.242 (Table 2). Thus, there appears to be a relationship between the errors in the grade estimates and the yield estimates. The

total variance is something more than the sum of the variances of yield and grade errors. Similarly, this correlation for the heifers was found to be +0.221 and for steers and heifers combined the coefficient was +0.257.

With these correlations available it would be possible to enter actual numerical estimates in the variance equation presented above. If we were to do so, this would appear to provide a measure of the combined yields and grade errors expressed in physical terms. This seems of no practical use, however, since it is not clear how the present marketing system would employ this combination of yield and grade error information. Prices as they are utilized in the market places must be introduced in some way to obtain value variances rather than a physical mixture.

Yet this approach in isolating and estimating the components of the physical yield and grade errors is useful in that it is independent of any set of prices. If a suitable value equation can be set up these components may help us in evaluating the value variances to be associated with these physical errors. On the other hand, if values had been inserted at the start and variances computed, the numerical results would have been applicable only to the set of prices chosen. Recomputation would have been necessary to illustrate the situation with changes in prices and the physical yields and grades assumed.

#### *Value Differences*

In the above we have developed and estimated certain statistical measures of the physical error components in estimating grade and yield errors for steers and heifers. These measures of the components could only be utilized in some form of value equation. The authors are not acquainted with the specific types of value equations employed by management and buyers in the livestock industry for pricing animals of varying yields and grades. Perhaps, even other factors should be introduced into a more complex value determinant. In our situation, we considered two types of such equations including only yield and grade.

In one value equation, individual animal deviations from average grade and yield were allowed to modify the price in a linear fashion. For the other model, relative deviations from average grade and yield were considered as modifiers of price. The latter, when its consequences were explored, seemed to give somewhat nonsensical results. Hence, we describe the former as follows: Animal value equals animal weight times price, or in symbols,  $V = WP$ . Now  $P$  may be considered as  $P^* + \Delta P$  where  $P^*$  is the average price (for a specified yield and grade, say). Then  $\Delta P$  represents a modification of the price of an individual animal due to the animal's deviations in yield and grade from the specified yield and grade for which the average price is to be paid. Let these deviations be

$\Delta Y$  and  $\Delta G$ . Further, we have considered these deviations strictly additive as a first approximation in their effect on  $\Delta P$ .

Thus we have  $P = P^* + C_1 \Delta Y + C_2 \Delta G$  where  $C_1$  and  $C_2$  are appropriate constants (in terms of cents per pound) for adjusting  $P^*$  for the yield and grade deviations of a particular animal. This gives our total value equation as  $V = W(P^* + C_1 \Delta Y + C_2 \Delta G)$ .<sup>9</sup> Now we may turn to what is observed in a specific instance. The following example has been constructed: Suppose a steer of 1000 lb. weight (errors in weighing are ignored), yield estimate (as a proportion) for this steer is 0.58 plus an error =  $0.58 + e_Y$  and the grade estimate is 11 plus an error =  $11 + e_G$ . A price of 25¢/lb. is to be paid for this steer if its yield is 0.60 and grade is 8 (the specified yield and grade noted above). Thus  $\Delta Y = -0.02 + e_Y$  and  $\Delta G = +3 + e_G$ . Next we need to assign price effects for  $\Delta Y$  and  $\Delta G$ ; for  $C_1$ , 46¢/lb. in carcass value is taken and  $C_2 = 1¢/lb.$  for a unit grade deviation. With these data the value of this steer in the example is found to be  $V = 1000 [0.25 + 0.46 (-0.02) + 0.01 (+3)] = \$271.20$ . This figure is obtained since  $e_Y$  and  $e_G$  are not observed.

The preliminary details have been somewhat lengthy but now we can return to value differences. The question is "What may be the error in  $V = 271.20$ , based upon the knowledge we have obtained about the errors in yield and grade?" The variance expression obtained is as follows:

$$\sigma_V^2 = (1000)^2 [(0.46)^2 \sigma_Y^2 + (0.01)^2 \sigma_G^2 + 2(0.46)(0.01) \rho_{YG} \sigma_{eG}]$$

Inserting the estimates secured above,  $\sigma_Y^2 = .0186$  (on a per pound basis),  $\sigma_G^2 = 1.0196$  and  $\rho_{YG} = +0.242$ , the estimate  $\sigma_V^2 = \$219.4$  is obtained from which  $\sigma_V = \$15$ , approximately.

The interpretation of this combined value variance (yield plus grade) for the constructed example is that about one-third of the time the buyer would have an error of \$15.00 or more per animal. About 5 percent of the time the error would be \$30.00 or more per animal. If the covariance term had been ignored, these figures would have been about \$13.50 and \$27.00 respectively. Thus, the covariance term is not of great practical significance since the value standard deviation is increased by only \$1.50 on a 1,000 pound animal or 15 cents per 100 pounds liveweight while the grade and yield errors contribute \$1.35 to the value standard deviation per 100 pounds liveweight.

Note that these errors may be either an overpayment or underpayment for the animals. In general, the lower yields and lower grade animals received less than their value and the higher grades and high yielding animals received more than their full value. This statement is based upon the observed regression results (actual on estimated yield or grade) presented earlier in this report. It would be of interest and useful to note

<sup>9</sup> Formally, we may express this as  $V = C_0(k + C_1x_1 + C_2x_2)$ , and we call our readers' attention to appropriate theorems on the variances of such linear combinations.

the improvement that could be obtained if the regressions found were used to correct the buyer's estimates. Since we have not fully explored the regression correction effect on the covariance term a precise statement is not made; but it appears that the total value variance might be reduced about 12% for the above example.<sup>10</sup>

### *Summary and Discussion<sup>11</sup>*

When a buyer estimated the carcass grade and yield of 219 steers and 74 heifers, it was found that he made some errors in estimating these variables. The error in estimating yield was as large as or larger than 1.7 percent about one-third of the time. The grade error was one-third of a full government grade or more about one-third of the time.

The buyer had a tendency to underestimate the yields of the low yielding animals and overestimate the yields of the high yielding animals. This buyer usually underestimated the grade of the animals that graded below average and overestimated the grade of those that graded above average. Further, he tended to overestimate the yield of those where he overestimated the grade and vice versa. This increased the total variance of the combined errors from that due to the separate errors in estimating yield and grade.

The relation between yield and grade errors was first explored independently of any prices. Then a simple value equation using only weight, yield and grade information was considered. This was necessary since the magnitude of the yield and grade errors and their covariance cannot be added in a measurable way until a common denominator in terms of prices is devised. The major value of the indirect approach is that the physical error measures may be used repeatedly as prices, yields and grades change without re-evaluating the components of a variance equation. Using certain assumed price data, the buyer would overestimate or underestimate the value of a 1,000 pound steer by about \$15.00 or more about one-third of the time.

Tests of significance indicated that there was a different error involved when this buyer estimated grades and yields of heifers than when he estimated the grades and yields of steers. However, the magnitude of the difference was not very large when measured in terms of dollars and cents.

<sup>10</sup> Whether or not this figure of 12% is an understatement or an overstatement, in general, is unknown at this time. As already noted the discrete variable, grade, introduces some difficulties. More important, however, is the whole problem of the value determinant for an individual animal or a lot of cattle. This area seems to offer a fertile field for further exploration by use of regression and other techniques. What factors can be introduced as useful predictors and how poses interesting problems. As an example, we used  $C_1$  and  $C_2$  as constants in our example, but surely estimation of these and other unknown parameters can be investigated.

<sup>11</sup> The conclusions of this paper are in essential agreement with those of the previous study from which these data were obtained, see footnote 3, above.

This analysis was made of only one buyer's estimates of the yield and grade of 293 animals. These data may or may not describe any other buyers. This study does, however, shed some light upon this important subject. If the data used in this study exemplify only a part of the population of buyers, it points to a need for improvement in our livestock marketing methods. Certainly farmers who allocate their resources in producing cattle could do the job more effectively if the pricing accuracy in marketing cattle could be improved.

Three possible ways of improving the pricing accuracy of marketing livestock include (1) improving the present method of marketing livestock on a liveweight and grade basis, (2) selling livestock on the basis of carcass weights or a guaranteed yield, and (3) selling livestock on a carcass weight and grade basis.

Undoubtedly some improvement can be made by training the buyers to do a better job of estimating grades and yields. The extent to which this first approach would be helpful is unknown. The authors wish to make clear that this report is not definitive in any respect. Particular facts presented in this paper cannot be considered to depict the situation in the industry; but some useful guides for operational research to be conducted by each firm in the industry have been indicated. Further, methodological procedures for processing some of the data to be collected have been outlined. Without going into detail, this listing outlines an approach to some aspects of the problem:

- (1) Measure the reliability of the official (government) grade established for individual carcasses of different weights and qualities.
- (2) Study the actual process of estimating grade and yield on the hoof and develop a training program for improving the buyers' estimates.
- (3) Institute a quality control program by keeping appropriate records of each buyers' performance.
- (4) Initiate studies designed to develop an adequate value determinant based upon those predictors that are available and found useful.

In case of the adoption of carcass weight or guaranteed yield for our example above, it would be possible to reduce the value variance by about 52 percent (33 percent due to yield error and 19 percent due to yield-grade error covariance). Using both carcass weight and grade would remove the yield errors and reduce the grade errors. The extent to which the grade errors would be reduced is unknown. Perhaps most of the grade error would be reduced by this method of sale.

This discussion considers only the pricing accuracy aspect of the system. Studies of the costs, reorganizations and other problems associated with any attempted improvements in marketing structure are needed before such changes should be recommended.

## MARKETING EXTENSION AND COMPETITIVE STRUCTURE\*

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THE contribution that extension work can make toward solving agricultural marketing problems is receiving more and more attention. This paper will attempt to show the value of recognizing differences in competitive structure in order (1) to specify goals that are practically attainable in marketing and (2) to design marketing extension programs to achieve the desired goals. It will then suggest guideposts that may be useful in developing marketing extension programs.

### *Efficiency: A Marketing Goal?*

The commonly stated objective of marketing extension, namely efficiency as this concept appears to be used, should be questioned or at least carefully qualified. The Extension Marketing Committee has stated that "Extension's objective in marketing is to raise the level of efficiency with which farm products are distributed from the farm to the consumer as a parallel to its objective of raising the level of efficiency with which farm products are produced."<sup>1</sup> At least two difficulties exist in such an objective. One is the problem of defining efficiency. A more important problem is that higher levels of efficiency may require changes or modifications in the competitive structure, causing conflicts among groups or conflicting with other values held by society. Are we justified in using the same unqualified objective in marketing that we appear to have commonly accepted for farm production?

### *What Is Meant by Efficiency?*

Efficiency in marketing can have a variety of meanings. Although the purpose of this paper is not to analyze definitions, it may be helpful to indicate some of the meanings and difficulties with these meanings in marketing.

One can distinguish between physical efficiency, in which physical input-output relationships are considered, and economic efficiency, in which resources must be allocated among various alternative uses in some optimum manner. As economic efficiency is the accepted criterion,

\* Journal Paper No. 935, Agricultural Experiment Station, Purdue University, Lafayette, Indiana.

\*\* This paper has benefited from criticisms of earlier drafts by my colleagues at Purdue. In particular I wish to acknowledge the suggestions of R. L. Kohls, J. W. Hicks, C. E. French, C. B. Cox, V. W. Ruttan, L. S. Robertson, and J. C. Bottum. The position presented, however, is that of the author.

<sup>1</sup> Report of the Ninth Meeting, Extension Marketing Committee, Washington, D.C., October 14-18, 1952, p. 2.

a further question is whether to deal with efficiency of the individual firm or efficiency in allocation of resources among firms.<sup>2</sup>

Another dimension of efficiency is technological progress over time. Should we concern ourselves chiefly with the optimum allocation of resources on the basis of a given state of technology? Or is technological change, possibly at the expense of some inefficiency in the use of resources on the basis of a given state of technology, more important?

Aside from these difficulties there is the problem of how to measure efficiency. Black and Houston point out that the most difficult part of marketing efficiency analysis is at the output end rather than with inputs.<sup>3</sup> Measurements of output attempt to evaluate the success of the marketing system in satisfying the wants of society. If these wants can be measured only in material goods and services, some over-all measurement could be approximated. But, if the marketing system is to maximize the quantity and variety of material goods and services society wants at least cost, conflicts among groups may develop. The extension economist faces the need for welfare criteria to resolve differences of this kind in the public interest.<sup>4</sup> An understanding of the competitive structure will help provide a framework in terms of which possible solutions can be evaluated.

### *Competition in Marketing*

Competition among marketing firms buying from and selling to farmers differs basically from competition among agricultural producers.<sup>5</sup> Because of this difference, both the approaches and the objectives of various marketing extension programs may need to differ from methods and programs that have proved effective in solving problems of farm production.

Two characteristics exist in marketing structures that do not exist in much of farm production. First, the marketing firm can use such factors as product and spatial differentiation, restrictions on the entry of new firms, and the interdependence of firm policies, to protect itself from some of the rigors of the competitive market. The marketing or processing firm has some opportunity to institutionalize its cost and to shift at least part of the incidence to society through greater control over prices

<sup>2</sup> See John D. Black and Neil T. Houston, *Resource-Use Efficiency in the Marketing of Farm Products*, Harvard Studies in Marketing Farm Products, Number 1-H, Cambridge, Massachusetts, June, 1950.

<sup>3</sup> *Ibid.*, p. 3.

<sup>4</sup> See, for example, Lawrence Witt, "Welfare Implications of Efficiency and Technological Improvements (In Marketing Research and Extension)," paper presented at the annual meeting of the American Farm Economic Association, August 1, 1955.

<sup>5</sup> J. K. Galbraith, "Agriculture and Competitive Structure," and L. J. Norton, "Discussion," *Journal of Farm Economics*, Proceedings Number, Vol. XXXVI, Number 5, December, 1954, pp. 743-750.

of products it sells or margins it can take. The individual farmer has no such market power. The other characteristic stems primarily from the ability of many marketing firms to lower costs with large scale production. If the criterion of a program is efficiency in the sense that the output of material goods and services is to be maximized at least cost, some firms will have to go out of business. Economic power will become more concentrated in those firms remaining.

The extension specialist in farm management works primarily within a structure of pure competition and he does not have problems connected with the concentration of economic power, restrictions on the entry of new firms, interdependence of firm policies or product differentiation. In some marketing structures, however, aside from the immediate loss that some firms may suffer if the efficiency of the marketing system forces them out of business, there is the longer run problem of the tendencies toward oligopoly or monopoly of those firms remaining. What, then, is the extension responsibility if analyses show that increased productivity in marketing tends to result in more concentrated economic power?

#### *Competitive Structure and Technological Progress*

A number of considerations should go into judging the performance of a marketing structure. Economic power may be held very tenuously. Further, static value theory tells us nothing about the productivity of a structure over a period of time. If we center our attention only on the extent of duplicated facilities, under-employed resources, margins that seem excessive, or concentrated power in a structure at a given time, we may conclude there is much room for improvement. But some marketing structures with these inherent tendencies may be those in which technological progress occurs at a rapid rate. Thus a progressive structure may be greatly preferred to a nonprogressive one, even though the former may possess undesirable characteristics on the static level.

However, if the state of technology and the types of firms in a particular structure are such that technical change is likely to be very slow, we might focus attention chiefly on making improvements within the given state of technology. We must be careful in making such a recommendation. Rigidities might be imposed that would prevent new ideas from being tried. Therefore, if improvements are made on the basis of a given state of technology, they should not be kinds that might restrict innovations or retard progress.

Ideally we might like to combine maximum efficiency in any given state of technology with maximum technological progress. But these goals are not usually consistent. The problem then is where to put the emphasis. We can not decide this conclusively.

We are not at a complete loss, however, to evaluate the progressive

characteristics of structures. Oligopoly is not inconsistent with progress.<sup>6</sup> Many oligopolists can set aside funds for research. Because of the continuing threat of losing part of the market to another oligopolist, the motivation to innovate is strong. The competitive model on the other hand may be relatively stagnant because of the lack of research funds. (If the research is carried on by other agencies on the behalf of firms that are purely competitive, this may not be true.) A monopolist may be able to finance the research but if he has no close competitors he is not usually motivated in that direction. Thus we have some theoretical analyses and empirical evidence to determine the progressiveness of different structures.

#### *Procedures in Program Planning*

Since a single homogeneous competitive structure does not exist in marketing, the kinds of market relationships among firms should be determined before specific programs are formulated.

This is not an easy task. Few structures fit distinct conceptual types. Moreover changes in the institutional environment and developments in technology modify structures. Variations of monopoly, oligopoly, and monopolistic competition will be found among sellers and as many corresponding variations among buyers.<sup>7</sup> However, in most situations some classification of structures can be made. Insofar as actual structures are found to conform to some extent to conceptual classifications, inherent tendencies can be more easily discovered and accurately delineated. Problems can be more clearly defined and extension programs can be designed more effectively to solve problems peculiar to each structure.

#### *Kinds of Problems and Suggested Programs*

Funds for marketing extension were provided to develop programs with farmers, marketing agencies, and consumers. Objectives in providing these funds were as follows:<sup>8</sup>

1. To aid the *farmer* in understanding the demands of the market, costs involved in marketing, and helping him with marketing procedures to meet these demands.
2. To aid *processors and distributors* in becoming better informed concerning marketing conditions and in becoming more efficient in performing these services to the end that farm products may move more efficiently through the channels with less waste, less loss of quality, and less cost, thus benefiting producers, handlers, and consumers.

<sup>6</sup> J. K. Galbraith, *American Capitalism: The Concept of Countervailing Power*, Boston: Houghton-Mifflin Co., 1952, p. 91 and J. S. Bain, *Price Theory*, New York: Henry Holt and Co., 1952, pp. 451-452.

<sup>7</sup> See, for example, William H. Nicholls, *Imperfect Competition Within Agricultural Industries*, Ames: The Iowa State College Press, 1941.

<sup>8</sup> Report of the Ninth Meeting, Extension Marketing Committee, p. 2.

3. To aid *consumers* in becoming more discriminating and more skillful in buying and using farm products; providing more healthful diets; and in gaining a better understanding of the marketing system.

And further "An adequate educational program in marketing must be geared to the concept that everyone concerned will be benefited. Such a program has to be in the public interest, but it must also be of direct value to farmers, those engaged in processing and marketing, and consumers. In carrying on a comprehensive educational program with these groups, consideration should be given to the problems and needs of the various groups involved."<sup>9</sup>

These statements indicate that extension programs in marketing should be in the public interest. But they do not recognize that characteristics of marketing structures differ and that goals of different groups may conflict. Some programs could not help all groups and still be in the public interest. Here guideposts are needed. The author suggests that for purposes of program planning, one of two broad courses be taken to provide a workable solution. Problems can be divided into those that can be corrected by greater market and technological knowledge and more competitive markets, and those that can not be solved without some kind of group action or social control.

#### *Problems Not Involving Change in the Competitive Structure*

In some situations marketing problems appear to stem primarily from imperfections in the marketing system. If the extension worker decides that the course he should take in such a situation is to try to make the market more competitive, one or more of the following programs may be appropriate: (1) a grading program coupled with a consumer information program, (2) a program that will make producers aware of varying practices of different buyers, or (3) a program of more complete, timely, and accurate market news quotations. If programs such as these make farmers and consumers more skilful in the market place, this may put increased pressure on marketing agencies to compete on the basis of price. Such pressure may stimulate the search for cost reducing techniques and thereby speed the adoption of new technology.

Technical information and research findings can be made available to help firms improve handling and operating methods, save labor and reduce wastes. Timely information about new technological developments can help reduce risks of investing in new machinery and techniques, shorten the time lag between the discovery and application of new technology, and make the widespread adoption of new technology

<sup>9</sup> Report of the Eleventh Meeting, Extension Marketing Committee, Washington, D.C., December 1-4, 1953, p. 3.

more orderly. Also, information about current economic developments can help firm managers plan future operations more intelligently.

#### *Problems Requiring Social Control or a Fundamental Change in the Existing Structure*

If information programs and the like do not come to grips with the basic problems, effective solutions may require some kind of group action such as marketing service programs (in addition to extension education), legislative changes, the possible development of new firms or new institutions, possible assistance in group organization to obtain such things as improved terminal facilities, and other physical as well as organizational improvements. Decisions involving the values and goals of different groups may be required. The relevant choice may be between more efficiency in a given state of technology and the possibility of a more rapid rate of technical progress. Or it may be between either of these and the loss of freedom by someone or some group. In some cases the apparent conflict may be small. The argument for increased efficiency in the output of material goods and services would then appear to be a strong one, particularly if it is the result of measures that make markets more competitive.

In other areas, the size and organization of firms may be such that competitive results can not be approximated without public regulation or direct restriction on the activities of some firms. Social control may also be necessary to preserve or to obtain a structure that will continue to be technologically progressive. Here extension can contribute most by analyzing problem situations and by outlining the alternative courses of action and consequences of these alternatives. Both short and long run consequences should be analyzed. Such analyses should also include untried courses of action, and the objectives of different interest groups should be taken into account.

In following this procedure it may be found that some objectives are relative. Group decisions may vary according to whether a large or small amount of goods and services would need to be given up for certain freedoms.<sup>10</sup> The possible increase in the output of material goods and services may be large in comparison with the loss of freedom; or the increase in one kind of freedom may more than offset the loss of another. In such cases the course of action chosen will depend largely on the relative gains and losses of different objectives. Extension can make an important contribution by helping find solutions to marketing problems of this kind.

<sup>10</sup> The concept of the marginal substitution of social values seems relevant in this context. This framework was developed by Dale E. Hathaway in his article, "Agricultural Policy and Farmers' Freedom: A Suggested Framework," *Journal of Farm Economics*, Vol. XXXV, Number 4, Nov., 1953, pp. 496-510.

## WEANERS, YEARLINGS, OR TWOS

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MANY ranchers are asking the question, "Should I sell weaners, yearlings, or twos?" Implicit in the question is the idea of maximum profitability in both the short and long run. It involves integrating feed supply, animals and prices. Each ranch has its own peculiar problems, but there is some general biological arithmetic that is inescapable.

Cows wear out or die, become unproductive in a general or specific sense, and so replacements are required. For example, we will assume that heifers are bred as yearlings, that  $R$  cows must be replaced annually, and that  $D$  animals die each year which is uniform for all classes. The calf crop  $K$  is based on the number of calves weaned in relation to the opening inventory of cows (which includes two-year-old heifers).

Although bulls are an important cost factor, particularly on weaner operations, we will ignore them in these calculations in the interests of simplification. Assume artificial insemination if you like.

$$\text{Cows} = x$$

$$\text{Yearling heifers} = Rx + DRx \text{ or } x[R(1 + D)]^1$$

$$\text{Total} = x[1 + R(1 + D)]$$

This assumes yearling heifers to be equal to one animal unit as are cows. If we use yearlings = 0.8 animal units, the total number of animal units then becomes:  $x[1 + 0.8R(1 + D)]$ . This expression can be equated with the carrying capacity of the ranch in terms of animal units to calculate the number of cows, etc. The argument may wax loud and long on the yearling animal unit factor. The factor used will vary with the particular operation, range type, feed quality and so on. It is apparent that a difference in the calf crop has no effect on the inventory composition of a weaner "spread."

For a yearling outfit, the inventory is  $x(1 + 0.8K)$ . It is now apparent that calf crop  $K$  is going to affect the herd composition and a value for that factor has entered the inventory calculation. The magnitude of the animal unit factor for yearlings also has become of greater significance.

For a two-year-old outfit the inventory is:

$$\text{Twos} = Kx - DKx - Rx, \text{ or } x[K(1 - D) - R]$$

$$\text{Total} = x[1 + K + K(1 - D) - R]$$

When two year olds become the main basis of sale along with cull cows, all three of our constants enter into the inventory calculation. On an animal unit basis we use everything in the book and the total becomes:

<sup>1</sup> +  $RD^2 x$ . This factor is negligible.

$x[1 + 0.8K + K(1 - D) - R]$ . The twos that are available for sale amount to the number of calves, less the death loss at the yearling stage, less the yearlings that were used to keep the cow herd up to normal and less the twos that died before time of marketing. It is relatively simple to separate out the two-year-old heifers from the steers, but we will leave that out of this chapter.

### Sales

The above arithmetic is useful in juggling feed supplies, but dollars are the most interesting feature of business. These dollars are very dependent on the number and the class of animals that are available for sale. On all operations there will be cull cows to sell. But the proportion of these as well as the number varies considerably according to our biological arithmetic. The number of cows sold is simply the total replacements less those that die ( $R - D$ ). In the case of weaners, the number of cows sold remains constant with varying calf crops. In the case of yearling or two-year-old setups, the number of cows sold will vary with the calf crop.

The sales of weaners, yearlings, or twos is a little more involved but is predicated on the calf crop, inventory, replacements, and death loss. For the weaner operation, all the calves will be sold except those required for cow replacement. Calf sales are:

$$Kx - x[R(1 + D)], \text{ or } x[K - R(1 + D)].$$

For the yearling operation, sales consist of the opening inventory of yearlings reduced by the death loss of yearlings, and further reduced by the number thrown into the breeding herd. The expression is:  $Kx - DKx - Rx$ , or  $x[K(1 - D) - R]$ .

The animal unit conversion factor, 0.8, is dropped when dealing with the number of animals to be sold.

In the process for twos the number of head sold is the inventory less the death loss, or  $x[K(1 - D) - R](1 - D)$ .

### Output

By simply applying a sales weight for cows, weaners, yearlings, and twos the output of live beef may be determined easily. Data from the intermountain area indicate average sale weights of cows as 1,020 pounds, weaners 390 pounds, yearlings 690 pounds, and twos 950 pounds.

### Gross Receipts

The foregoing biological arithmetic cannot be evaded. Values of  $K$ ,  $R$ ,  $D$ , and weights may change but the general formulae still stand. The problem of the rancher is to combine this arithmetic of biology with that

of prices. We seek to establish isorevenue curves. Or as the rancher will put it, how to come out on a yearling operation to equal the take on a cow-calf outfit. Here is how it looks to equate the price of yearlings  $p''$ , with the price of calves  $p'$ , given a price of cull cows,  $p$ .

$$p'' = \frac{(1 + 0.8K)[(R - D)wp + \{K - R(1 + D)\}w'p'] - (R - D)wp}{1 + 0.8R(1 + D)} \quad [K(1 - D) - R]w''$$

where:

- $K$  = Calf Crop percent
- $R$  = replacement rate of cows
- $D$  = death loss percent
- $w$  = sale weight of cows
- $w'$  = sale weight of calves
- $w''$  = sale weight of yearlings
- $p$  = selling price of cows per pound
- $p'$  = selling price of calves per pound
- $p''$  = selling price of yearlings per pound

This formula tells the price of yearlings,  $p''$ , that is necessary with a given price of cows and weaners, so that the total receipts from a yearling operation and a weaner operation are equal. This can be a useful tool in budgeting.

The general formula for equating the price of two year olds with that of yearlings is:

$$p''' = \frac{[1 + 0.8K + K(1 - D) - R] \left[ \frac{(R - D)wp + K(1 - D) - R w'' p''}{1 + 0.8K} \right] - (R - D)wp}{[K(1 - D) - R](1 - D)w'''}$$

where:

- $K$  = calf crop percent
- $R$  = replacement rate of cows
- $D$  = death loss percent
- $w$  = sale weight of cows
- $w''$  = sale weight of yearlings
- $w'''$  = sale weight of twos
- $p$  = selling price of cows
- $p''$  = selling price of yearlings
- $p'''$  = selling price of twos

Although these general formulas may seem somewhat cumbersome, it is necessary that they be presented so that values to fit any particular situation can be inserted. They are a useful first step in budgeting. But they are incomplete in themselves so far as giving the answer to the initial question posed of "what is the most profitable in the short and long run." Cost data, primarily wintering costs, are needed to get at a net income figure. Price analysis of trends and differentials are needed for both the short and the long run. Possibly some of the regional research projects will provide some of this necessary ammunition.

### *Examples*

Two practical examples will show how the method works. In these examples replacement rates of 20 percent and death loss of 3 percent are used. A weaner operation is compared with a yearling setup, with calf crops of 70 and 90 percent. Assume cows selling at \$10.00 per cwt. and weaners at \$20.00. This gives us:

$$\begin{array}{lll} K = .9 & w = 1020 & p = .10 \\ R = .2 & w' = 390 & p' = .20 \\ D = .03 & w'' = 690 & p'' = ? \end{array}$$

Substituting these in the formula, we find:  $p'' = .1905$  or \$19.05 per cwt. This is the price that would give a yearling outfit the same gross receipts as a weaner operation if both had 90 percent calf crops, and other conditions as stated. If the calf crop percentage is dropped to 70, it is found that yearlings can be sold for \$17.47 per cwt. and give the same total receipts as a weaner outfit selling calves at \$20.00. With the change in calf crop percentage the required differential has dropped from 95¢ to \$2.53 per cwt.

If we introduce this \$17.47 price and a 70 percent calf crop into the two-year-old equation, we find that a price of \$18.28 would have to be obtained for twos to gross the same. At a 50 percent crop a price of \$17.08 for twos would give an equal gross.

There appears to have been a significant shift to weaner sales in some range areas starting in 1950 or thereabouts. That shift in 1955 gave some indications of a partial reversal. The price relationships in '51 and '52 were a basic stimulus. With cows at \$25.00 and weaners at \$40.00 and an 80 percent calf crop, it takes a price of \$37.32 for yearlings to give the same gross. In 1951 when weaner prices were about as stated, yearlings were selling for \$33.00 to \$35.00. Obviously a shift to weaners was indicated.

These calculations can be carried on *ad infinitum*. Refinements, such as different death loss rates for different classes of animals, can be applied. There is need for someone to develop essential cost data and price-cycle data so that guides for a flexible type of ranch operation may be drawn up. Those operators capable of interpreting and acting on such analysis will benefit from their more efficient management.

## NOTES

### A NOTE ON ASPECTS OF LINEAR PROGRAMMING TECHNIQUE

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EARL O. HEADY has presented a nonmathematical treatment of the basic logic and computational procedure of the simplex method as applied to farm management.<sup>1</sup> Although this presentation is very helpful, more can be said in the same simplified fashion to clarify the basic logic as well as the computational procedure.

In the simplex procedure of computation we start with a program consisting of  $m$  disposal activities yielding zero profit, where  $m$  is the number of limited resources and each disposal activity corresponds to the disposal of a resource. Subsequently we "improve" the program by replacing one of those  $m$  activities by some more profitable one. We always have  $m$  activities productive (active) or resource disposing (disposal). Thus the simplex procedure guarantees the best program out of all possible programs involving  $m$  activities. But why can there not exist a production program with more or fewer activities than this fixed number  $m$ , and why can that not be the optimum one? Suppose we have  $n$  enterprises and  $m$  limited resources. Then we have  $n + m$  possible activities, including one each for disposal of unutilized resources. There could exist an enterprise, among the  $n$  enterprises under consideration, that completely utilizes all of the  $m$  fixed resources. In that case we have a production program of one activity only. Similarly there could exist two enterprises jointly utilizing all the given resources. We will then have a program involving only two activities. Proceeding in this manner we see that a production program can consist of all the enterprises with certain levels and also leaving some of the resources unused. Of course, some one of this set of all possible production programs is optimum.

The simplex method assumes that the optimum program exists in the subset of programs involving only  $m$  activities, productive or disposal. Can there not be an optimum solution with more or less than  $m$  activities involved? The answer to this question is "no," in general. The optimum solution must involve  $m$  activities. This can be demonstrated without resorting to complicated algebra. We may reproduce Figure 1 of Heady's paper showing the opportunity curve based on the availability of the restrictive resources.

<sup>1</sup>See Earl O. Heady, "Simplified Presentation and Logical Aspects of Linear Programming Technique," *Journal of Farm Economics*, Vol. XXXVI, No. 5, December 1954, pp. 1035-1048.

In this case we have three restrictive resources: land, capital, and September labor. Thus if we use the simplex method to get the optimum solution explained in Heady's paper,<sup>2</sup> we will start with three disposal activities as a trivial program with zero profit. The simplex procedure consists of replacing one of these by some productive activity. In the

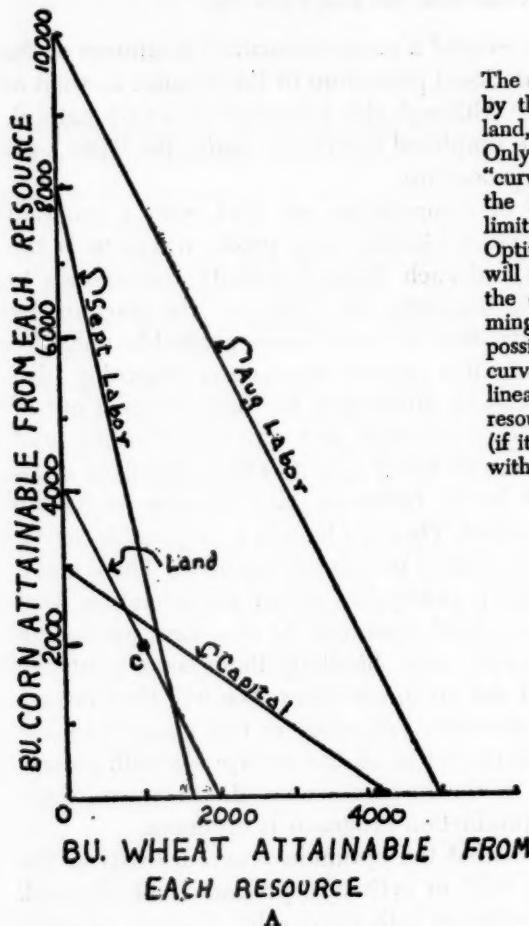
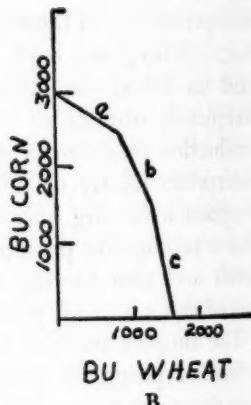


FIGURE 1

The opportunity curve in B is defined by the intersection of the 3 lines for land, capital and Sept. labor in A. Only the quantities defined on the "curve" for B are possibilities open to the firm. This curve considers the limitations imposed by each resource. Optimum production combinations will be at the "ends" or "corners" of the curve. We have linear programming conditions since segments of the possibility curve are straight lines. The curves on most farms likely are of this linear segment nature, because each resource prescribes a set of possibilities (if it had enough other resources to go with it).



second program we will have one productive and two disposal. Again if the second program is not the optimum, any of the three activities will be exchanged for a "better" one but we will always be confined to programs involving three activities. An activity is always interchanged with another one. We will reach the "best" program within that set up, that is, out of all programs involving three activities.

<sup>2</sup> *Ibid.*, p. 1047.

However, it can be easily seen from the figure that the optimum solution must involve three activities. It is clear that, depending on the price ratios of the two crops, the optimum solution is achieved on the corners of the broken line (the opportunity curve). If the price line is such that it touches at the upper end of  $a$ , the optimum program will include one productive activity, that is 3000 bushels of corn, but a part of land and September labor will be unused, which means that the program involves two disposal activities. Again if the price line touches the curve at the lower end of  $a$ , the optimum program will involve both productive activities, production of corn as well as wheat. Both the available land and capital will be consumed but there will be a surplus of September labor which means that the program includes one disposal activity. Hence we see that the optimum program always involves three out of all activities, productive and disposal. Generalizing this we find that the optimum solution cannot involve more than  $m$  activities, active or disposal, where  $m$  is the number of limited resources given in any problem.

A rare possibility of exception to that generality exists. For instance, if the price line coincides with any of the segments of the broken line (the opportunity curve), any point of that segment gives a solution. The corners will give solutions with 3 activities (one or two productive, the rest disposal). An intermediate point like that of  $a$  will give an optimum solution involving both productive activities and two disposal activities, one for the unutilized land and the other for the unutilized September labor. Thus, this point, assuming that the price line coincides with  $a$ , gives an optimum solution involving four and not three activities. Since all points of the line segments  $a$  will serve as well, the simplex procedure will give us a solution corresponding to one of the corners. In that case, the simplex method will serve the purpose of giving some optimum solution, out of the totality of optimum solutions. If one is interested to know all possible optimum programs, techniques are available to locate such totality of programs.<sup>3</sup>

### Degeneracy

Another problematic situation that sometimes arises is that of "degeneracy." To explain this we again refer to the figure. Geometrically, the simplex procedure consists of starting with a trivial program located at the origin. It consists of no productive activity and three disposal activities, one corresponding to each of the limited resources. At the second stage we move from the origin to either extreme of the opportunity curve which gives us a program consisting of one productive activity and two

<sup>3</sup> A. Charnes, "Optimality and Degeneracy in Linear Programming," *Econometrica*, 20:2, April 1952.

disposal activities. If this program is not optimum, depending on the price ratios, we move to another corner point that represents a combination of both productive activities and one disposal activity. At successive stages of the simplex procedure we move from one corner to another always improving the "value" of the program.

Now let us consider a situation in which the line segments  $a$  and  $b$  of the opportunity curve were parts of the same straight line. In other words, the available quantities of capital and land and their input coefficients for wheat and corn are in such proportions that the opportunity lines corresponding to these two resources coincide. In the simplex procedure it is suggested that we move from the origin to the upper end of  $a$ . In other words we propose to bring in corn production activity. This incoming activity will replace one of the two disposal activities, corresponding to capital and land. In the procedure as commonly described a tie will occur. If we refer to Heady's instructions two equal ratios will occur and we will be at a loss to decide which of the two corresponding activities is to be thrown out of the program.

The proper procedure to handle this situation is to compare the next ratios on the right and select for replacement the activity corresponding to the smaller of these two. If these are also equal, we compare succeeding ratios until the tie is broken.

Whichever of the two (or more in a general case) disposal activities is replaced, the level of the other disposal activity will automatically be zero in the subsequent stage (or matrix). This is apparent in the simple case corresponding to the figure. When we move from the origin to the upper end of  $a$  (assuming  $a$  and  $b$  to be the same straight line), our program will consist of one productive activity (corn) and the disposal activity corresponding to unused September labor. This is said to be a degenerate solution because it involves activities fewer than the number of limited resources under consideration.

We have noticed that it is possible to have an optimum program involving more of fewer activities than the number of fixed resources. Also we have seen how such situations are liable to arise and how they should be handled. In general, however, the optimum program will contain exactly  $m$  activities, active or disposal, where  $m$  is the number of fixed resources.

The above discussion not only clarifies some further basic aspects of linear programming but also provides a background for some of the stochastic models that are being presented these days,<sup>4</sup> which assume that the optimum program involve exactly  $m$  activities.

<sup>4</sup> M. M. Babbar, "Distributions of Solutions of A Set of Linear Equations (with an Application to Linear Programming)," *Journal of American Statistical Association*,

### Computational Procedure

In regard to the computational procedure presented by Heady the following observations may prove to be of help:

One of the basic assumptions of the presentation is that the disposal activities have zero "value." The value criterion used in the empirical example is the gross capital return per unit of the activity. In the case of productive activities (crops) this is the price per unit of the output. In the case of disposal activities assumed to be zero, this procedure is liable to lead to erroneous results, since the unused capital does not have "zero" value. This error can be easily corrected by taking prices corrected (in net price sense) for the capital expense per unit of productive activities respectively instead of gross prices. In other words, correct the error by subtracting the capital input coefficients for each crop from the "prices" per unit respectively. Similarly if the unused land or labor can be freely disposed for some alternative use yielding monetary gain per unit, the "prices" of the activities may be corrected accordingly. We will still be looking for the best production program within the physical limitations of the availability of the resources, although taking into account the alternative uses available for resources not required for the class of production programs under consideration.

The same situation can be achieved by retaining the gross prices as the value of the crops and entering in respective cells the value per unit of the disposal activities accordingly. For instance, the gross return per unit of the disposal activity in regard to capital is one dollar. Thus the number 1 should be entered in the corresponding cells. The whole procedure, from there on, can be carried on in the usual manner.

### Checks

Lastly, the following checks for computation may be helpful in empirical application:

The table of computation presents a number of successive stages (matrixes), each one giving an "improved" production program. The entries under the first supply column give the levels of activities that form the production program. In the scheme presented by Heady,<sup>5</sup> the levels of disposal activities directly give the amounts of corresponding unused resources. The levels of the productive activities give the yields to

Sept. 1955. M. M. Babbar, Gerhard Tintner and Earl O. Heady, "Programming with Consideration of Variation in Input Coefficients," *Journal of Farm Economics*, Vol. XXXVII, No. 2, May 1955.

<sup>5</sup> The writer of this note was the first to use that scheme in his doctoral thesis at Iowa State College, with inspiration and guidance from Gerhard Tintner and Earl O. Heady. He also wrote the simplified computing instructions that were distributed among other graduate students. Heady's "mechanical instructions" presented in the table form are concise and clearer.

be achieved by carrying on those activities. The amounts of the resources required to do so can be easily calculated by multiplying those levels of the productive activities by the corresponding input coefficients given in the first stage (matrix) of the computation table.

The amounts of the resources required by the productive activities of a production program and the amounts of the unused resources must add to the total amounts of the resources available. This calculation, done at every stage (matrix) or at least in the final stage of the computation table, provides a valuable check on computational errors.

Another important check is provided by two-way calculation of the marginal return at every stage (matrix). One way of calculating the same is by finding the value of the program suggested at every stage and the other, by the usual procedure of calculating any entry of a new matrix. At every stage (or matrix) a new "better" activity is introduced in the program and the row corresponding to that activity in the new matrix is completed. If any entry of that new row is zero, the column corresponding to that entry will have entries exactly the same as the corresponding entries in the previous matrix except the zero entry itself.

All these checks are negative in nature. If they are not satisfied, some computational error has taken place. But if they are all satisfied, there may still be some error in the process. Our experience shows that the error is ultimately detected by these checks in almost all cases.

#### ERRATA

In the appendix of our Article "Programming with Consideration of Variations in Input Coefficients" published in the May 1955 issue of this *Journal*, there are certain omissions of a formula that make the relative statements erroneous.

(1) In formula (4) on page 340, there should be  $j$  instead of  $i$  as index of second summation.

(2) The last three lines on page 340 should read as follows:

Tables are given for positive values of  $h$  and  $k$  only. If either one of these (say  $-k$ ) is negative, we use the following formula:

$$\int_{-h}^{\infty} \int_{-k}^{\infty} N(\rho) = \int_h^{\infty} N(0, 1) - \int_h^{\infty} \int_k^{\infty} N(\rho)$$

and if both quantities are negative, suppose  $-h$  and  $-k$  are both negative, we use the following formula:

$$\int_{-h}^{\infty} \int_{-k}^{\infty} N(\rho) = 1 - \int_h^{\infty} N(0, 1) - \int_h^{\infty} N(0, 1) + \int_h^{\infty} \int_k^{\infty} N(\rho).$$

(3) Formula (2) on page 341 should be read as follows:

$$\sigma_{N(y)}^2 = \sum_{r=1}^m \left( \sum_{i=1}^m C_i \beta_{ri} \right)^2 \tau_i^2 + \sum_{r=1}^m C_r^2 \sum_{i=1}^m \sum_{\substack{j=1 \\ j \neq r}}^m (D_{ijr})^2 \sigma_{ij}^2 + \sum_{r=1}^m |D^r|^2 \omega_r^2.$$

(4)  $B_{ij}$  in formula (3) on page 341 is  $\beta_{ij}$ , and capital letter  $C_r$  in all these formulas is the same small type coefficient  $c_r$  of  $x_r$  in the linear function.

M. M. BABBAR, GERHARD TINTNER AND EARL O. HEADY

## MEMBER BEHAVIOR AND OPTIMAL PRICING IN MARKETING COOPERATIVES

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### I

THE development of the discussion on the pricing policy of cooperatives and economic analysis of cooperatives in general over the last three years in this *Journal* seems to take a course that fatally points towards a revival of that famous controversy on the marginal cost pricing principle of the 1930's, this time applied to the cooperative field.

The central and theoretically conspicuous point of the latest contribution<sup>1</sup> is, in effect, an attempt to substitute average cost pricing for marginal cost pricing in marketing cooperatives. Among students of price theory, there should be no serious discussion as to the theoretical soundness of the marginal cost pricing principle with regard to the marketing cooperative also, as demonstrated by Hirsch<sup>2</sup> and Phillips.<sup>3</sup> Therefore I apologize for producing another diagrammatic proof of the marginal principle, differing from the one used by Phillips. Yet this procedure is necessary because the new diagrams serve equally as a starting point of the following discussion on problems of *member information* and *member behavior*, as far as the *realization* of the profit maximization condition is concerned. Like most of my predecessors in the controversy, I shall

\* The author wishes to express his gratitude to Dr. Katherine Elisseieff for valuable suggestions.

<sup>1</sup> O. Aresvik, "Comments on 'Economic Nature of the Cooperative Association,'" *Journal of Farm Economics*, Vol. XXXVII, No. 1, February 1955, pp. 140-144, esp. p. 141.

<sup>2</sup> W. Z. Hirsch, "The Economics of Integration in Agricultural Marketing," Unpublished Ph.D. Thesis, University of California Library, Berkeley, 1950.

<sup>3</sup> R. Phillips, "Economic Nature of the Cooperative Association," *Journal of Farm Economics*, February 1955, pp. 79-87.

limit my contribution to short run analysis, excluding polyperiodic and multiproduct problems.

## II

For the sake of clarity, let us restate the existing differences of opinion. While Phillips produces the statement that "The cooperative firm equates the sum of the marginal cost in its individual plant or plants and the marginal cost in the joint plant with the marginal revenue facing the firm in the market where the product is sold,"<sup>4</sup> Aresvik holds that ". . . under the assumption of profit maximization, a participating firm in a marketing cooperative association equates the sum of the marginal cost in its individual plant or plants, plus the average cost in the joint plant with the average revenue facing the joint plant in the market where the product is sold."<sup>5</sup> Using *mpr* for marginal joint plant revenue, *mpc* for marginal joint plant cost, *mmc* for marginal cost of the member plants, *apc* for average cost of the joint plant, and *apr* for average joint plant revenue, we may state both versions of the maximization condition by the following equations:

- (1)  $mpr \equiv mmc + mpc$  (marginal principle)
- (2)  $apr \equiv mmc + apc$  (average principle)

As can be seen from the equations, there is disagreement both on the revenue as well as on the cost items. To simplify matters, we shall deal with each of these topics separately, starting with the revenue item.

In order to isolate the revenue item under discussion, let us assume that the joint plant of the marketing cooperative has constant average variable costs and no fixed costs, as actually happens in some types of simple cooperatives, so that average variable joint plant costs (*avpc*) are identical with marginal joint plant cost and average joint plant cost

$$(3) \quad avpc = mpc = apc$$

<sup>4</sup> Phillips, *op. cit.*, pp. 79-80.

<sup>5</sup> Aresvik, *op. cit.*, p. 141. Since we cannot assume Aresvik presents his argument only in order to point out that cooperators *actually* do base their producing and selling plans on average joint plant return and average joint plant cost, we have to consider his proposition as a *new pricing theory of the marketing cooperative*. Otherwise his reasoning could be no challenge to Phillips' analytical statement and would be not much more than a banality. The acceptance of this new pricing theorem would have been easier, had Aresvik not agreed to the marginal principle for the single integrated firm. As it is, his solutions for the single firm case on the one hand, and the cooperatively integrated firm on the other, show an asymmetry, in contrast to Hirsch's and Phillip's symmetrical solutions for both types of firms. One of Aresvik's most important tasks would therefore have been to show *why* the single firm solution does not apply to the collectively integrated firm, since the fundamental condition, i.e. integration, is for both firms the same. There seems to be *a priori* no reason why, analytically, the maximization condition in the one case should be different from the other.

This assumption would eliminate the disagreement on the cost item in the two conflicting maximization formulas and would allow us to concentrate exclusively on the question of what happens to profit in marketing cooperatives out of the integrated processes (production *and* marketing), if in equation (1) marginal revenue of the joint plant is replaced by average revenue.

The profit maximization output is  $m$  (in Fig. 1) where aggregate marginal members' cost plus average joint plant cost equals marginal revenue. Profit for both operations, production *and* marketing, is average

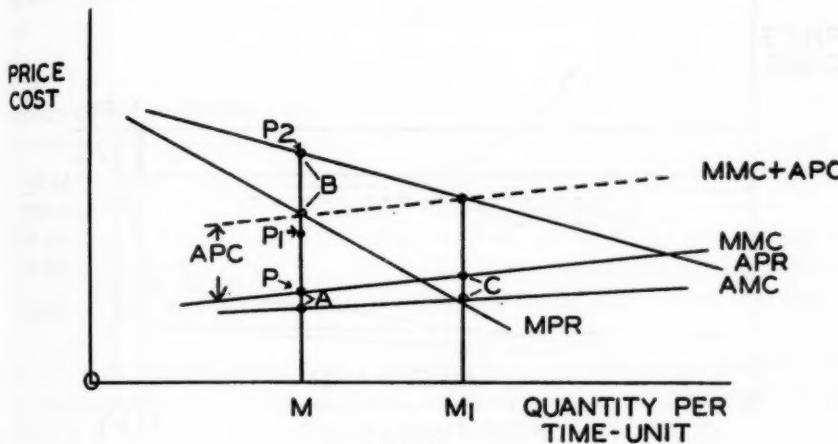


FIG. 1

joint plant revenue minus the sum of average joint plant cost plus average member cost (*amc*) times output, or

$$(4) \quad P = [apr - (apc + amc)] \cdot q$$

Designating profit from production *and* marketing by  $a$  and  $b$  respectively, we could define profit at  $m$  in Fig. 1 also as

$$(4a) \quad P = (a + b) \cdot m$$

Profit at output  $m$  is obviously maximized, since the additional cost for producing *and* marketing each marginal unit to the left of  $m$  is lower than the additional revenue from selling this unit. On the other hand, any marginal unit to the right of  $m$  costs more in producing and marketing than the additional revenue it will bring in the market.\*

\* In order to use Fig. 1 without modification, as diagrammatical presentation of the maximizing equilibrium position of the single member unit, we must assume that total delivery to the joint plant is always allocated equally between the members, and that their cost curves are identical. Supposing, in addition, the number of members to be, for example, 100, we would merely have to reduce the scale on the X axis by 1:100, and all curves in Fig. 1 become those of the member unit.

Aresvik's average principle (2) instead would require output  $m_1$  in Fig. 1, where profit is necessarily lower than at  $m$ . According to equation (4) profit would be only

$$(4b) \quad P = c \cdot m_1^*$$

We therefore conclude that replacement of marginal joint plant revenue by average joint plant revenue in equation (1), as proposed by Aresvik, leads away from optimum output and maximum profit.

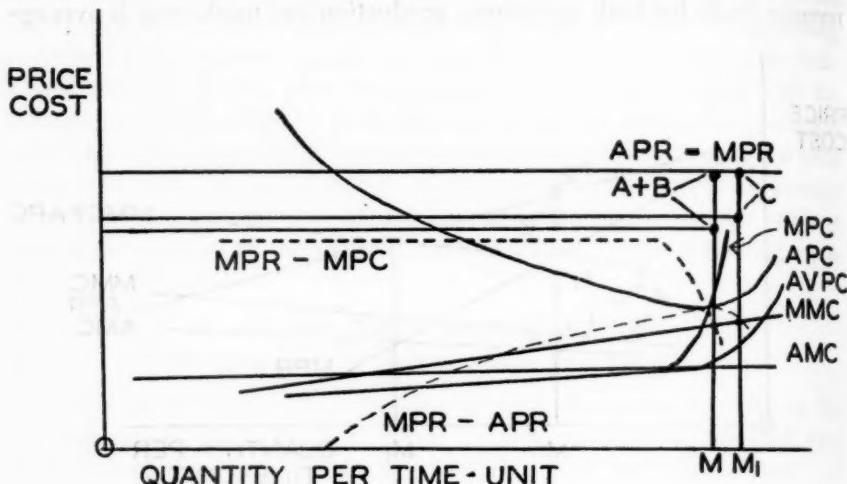


FIG. 2

Our next step is to deal with the controversy on the cost item. In order to isolate it from the revenue item, let us assume perfect competition in the selling market of the joint plant. This assumption would secure identity between marginal and average revenue of the joint plant.

$$(5) \quad mpr = apr$$

By retaining our assumption of marginal joint plant cost-constancy over a considerable range of joint plant capacity,<sup>8</sup> Fig. 2 gives the solution.

According to equilibrium condition (1), profit maximizing output for the integrated operations is  $m$  (in Fig. 2) where profit, according to (4), is  $P = (a + b) \cdot m$ .<sup>9</sup> If we now replace (according to Aresvik's reasoning)

<sup>8</sup>  $c$  defined as profit per unit of output from production at  $m_1$ .

<sup>9</sup> This assumption must not necessarily be considered merely as a means of exposition, if there is agreement on the point that in distributive activity constant marginal cost is a general phenomenon.

<sup>10</sup> Output  $m$  in Fig. 2 is determined by the intersection of curve  $mmc$  with the auxiliary (dotted) curve  $mpr-mpc$ .

marginal joint plant cost by average joint plant cost in equation (1), we get instead the larger output  $m_1$  in Fig. 2, where profit is clearly lower, i.e. according to (4),  $P = c \cdot m_1$ .<sup>10</sup>

The conclusion we have to draw from our foregoing analysis is that the marginal principle (1) is the analytically correct statement for the profit maximization condition for a cooperative marketing association. If members therefore actually do equate "net return" (average joint plant revenue minus joint plant cost)<sup>11</sup> with their marginal cost, according to Aresvik's average principle (2), profit maximization for the integrated process is impossible.<sup>12</sup>

### III

So far we have intentionally avoided the interesting question whether or not the members are able to realize the profit maximizing output according to (1). What are the conditions to be fulfilled on the part of the members? Aresvik remarks that members "face"<sup>13</sup> not marginal joint plant revenue, but average revenue. This particular member behavior seems to make him reject the marginal principle (1) and replace it by the average principle (2). We shall follow Aresvik in distinguishing between member information and member behavior,<sup>14</sup> using the latter term instead of "facing." By basing its plan on certain revenue and/or cost values, the economic unit "behaves" in a corresponding manner. If, to give an example, the member unit bases its plan on average revenue as Aresvik assumes, it behaves as quantity adjuster (Frisch).<sup>15</sup>

What conditions with regard to member information and member behavior ought to be fulfilled in order that profit maximizing output in the sense of (1) can be realized? A short reflection on the case of the single integrated two plant firm (producing and marketing) demonstrates that the maximizing unit must (1) be informed on the shape of the cost curves in both plants and the revenue curves of the selling plant, and (2) in conformity with this information, base the integrated producing and selling plans of the two plants on the *marginal* curves in order to maximize profit.

From the second condition follows the important point that, because of integration, the structure of the market where the selling unit is operat-

<sup>10</sup> Output  $m_1$  in Fig. 2 is determined by the intersection of curve *mmc* with the auxiliary (dotted) curve *mpc-apc*.

<sup>11</sup> Aresvik, *loc. cit.*, p. 141.

<sup>12</sup> If marginal and average joint plant revenue are not identical and/or marginal joint plant cost differ from average joint plant cost.

<sup>13</sup> Aresvik, *loc. cit.*, pp. 140-141.

<sup>14</sup> Aresvik, *loc. cit.*, p. 142.

<sup>15</sup> By considering the selling price (average revenue) as given and adjusting output in such a way as to maximize profit.

ing is reflected backwards, through all integrated stages, up to the maximizing unit, as far as behavior is concerned. If in our example the selling plant is a monopolist, and the producing plant is the maximizing unit, the latter must behave as a monopolist, i.e. it must base its production plan on marginal revenue and use either quantity fixing or price fixing, even though there is no market between the two plants.

Since those two conditions hold good for the maximizing unit of a marketing cooperative as well, irrespective of whether an internal transfer price is paid or not, there follows immediately from the first condition that there can be no profit maximization in the marketing cooperative unless members are fully informed on the shape of the joint plant's revenue and cost curves. In the absence of such information members cannot but base their production plans on net return, i.e. they have to behave as quantity adjusters. If, moreover, members do not anticipate any patronage refunds, they regard preliminary price as net return. Such being the case, variations of preliminary price become a welcome instrument on the part of the joint plant's management aiming at profit maximizing output in the sense of (1). Consequently, management would have to fix preliminary price at  $p$  (in Fig. 1), in order to obtain from members a total delivery of no more and no less than  $m$  (in Fig. 1).<sup>16</sup>

Most students of cooperatives would probably agree that, in nearly all cases, members of marketing cooperatives are not informed on the shape of the joint plant's revenue and cost curves. Variations of preliminary price would consequently seem to be a practicable alternative towards securing profit maximizing output. Yet the weak point would still be the assumed behavior of members as quantity adjusters. We must bear in mind that final price (net return) would be higher than preliminary price; so at the end of the planning period price would rise to  $p_1$  (in Fig. 1).<sup>17</sup> Therefore, in the next period, members would expand output, thereby at least partly defeating this particular policy of management.

If the joint plant's management nevertheless insists on realizing profit maximizing output, there remains no remedy but to fix output also at  $m$  (in Fig. 1). Such management policy has its striking counterpart in monopsonistic price-quantity fixing, with the difference that in the case of the cooperative the aim is not to maximize the profit of the fixing unit (joint plant), as is traditionally presumed in price theory, but that of the

<sup>16</sup> Because of the assumed quantity adjustment,  $mmc$  in Fig. 1 becomes the members' aggregate supply curve.

<sup>17</sup>  $p_1$  is equal to the difference between average joint-plant revenue and average joint-plant cost at  $m$ .

option takers (Frisch),<sup>18</sup> i.e. members. If the management decides in favor of price-quantity fixing, the difference between final and preliminary price would lose its importance, insofar as profit maximization of member units is concerned.

Price-quantity fixing by the joint plant would be equally necessary in the other case, when members are fully informed on the joint plant's falling revenue and cost curves, and yet behave as quantity adjusters.<sup>19</sup> In that case also, variation of the preliminary price (as the management's policy to realize profit maximizing output) would again be ineffective, since members, because of their assumed information, would know the final price too, correctly anticipating therewith the patronage refund, no matter what the preliminary price might be.

This behavior of members as quantity adjusters—which is not in conformity with their information on the joint plant's falling revenue—deserves some further consideration, because it is not necessarily inconsistent with economic rationality, or with their profit motive. This obviously would be the case if a single-firm integrated monopolist behaved as a quantity adjuster. The reason is that in the case of a cooperative a *multiplicity* of economic units are integrated jointly with a single plant. The joint plant's capacity is therefore many times larger than that of the individual member units. Because of this *capacity* difference members, as a rule, may consider the joint plant's current selling price as given and independent from their individual output variations, i.e. behave as quantity adjusters.

The capacity argument may play its role also with regard to the cost item. Because of the above mentioned capacity difference, members may consider the joint plant's current costs also as given and independent from their own individual output variations. However, it is not only this difficulty that requires consideration in connection with the cost item. There arise additional complications, stemming from the problem that the joint plant's fixed costs are not necessarily "fixed" from a member unit's point of view also. Members *in toto* have to bear their joint plant's fixed costs, irrespective of how large or how small the joint plant's output may be. But what is true of the whole membership, is not necessarily true for the single member unit. As a rule, the joint plant's fixed costs are allocated to the members on an average (per output-unit) basis, together with the joint plant's average variable costs. Consequently, the single member's share in the joint plant's fixed costs varies directly with its

<sup>18</sup> With regard to the concept "option-taker" cf. E. Schneider, *Pricing and Equilibrium*, London: William Lodge & Co., 1952, p. 58.

<sup>19</sup> This is Aresvik's assumption. Cf. *op. cit.*, p. 142.

individual output variations. Therefore members may consider average joint plant costs as marginal cost for selling through the joint plant, and again profit maximization would be impossible, since members would add to their own marginal cost not the joint plant's marginal cost but its average cost.

Since these complications arise not from the capacity argument as such, but from traditional cost accounting techniques, an appropriate adaptation of these techniques would seem the proper solution. For example, there could be applied a cost accounting scheme similar to that of block rating in public utilities. Under such a scheme each member would have to contribute his share in the joint plant's fixed costs according to a certain schedule that would have to be independent of the member's actual patronage with the joint plant (possibly in proportion to his capital contribution).<sup>20</sup> Members then could sell their output through the joint plant at its average variable cost and, if the latter coincides with the joint plant's marginal cost, members could analytically realize their profit maximum according to (1).

However, the introduction of this new cost accounting procedure leads to new analytical problems and difficulties that cannot be dealt with here.<sup>21</sup> But even more important seem to be the practical difficulties that in nearly all cooperatives and situations would defeat the workability of such an unorthodox accounting procedure in marketing cooperatives. Because of all these difficulties management would once more have to resort to price-quantity fixing in order to secure profit maximizing output. This solution of price-quantity fixing must be considered as the final and logical outcome also of all the other cases dealt with above. That this analytically necessary policy of price-quantity fixing has any chance of being accepted by members more than very seldom seems highly questionable in the light of the opinion prevailing among practical cooperators that their joint plant must market any quantity they choose to produce.

### Conclusions

The conclusion we must draw from our analysis of member information and member behavior with regard to the realization of maximum profit according to the analytically correct profit maximization condition (1) can therefore only be a skeptical one. The reasons for this skepticism are (1) members as a rule are not informed on their joint plant's cost

<sup>20</sup> Capital contribution being proportional to the members' planned long run patronage with the joint plant.

<sup>21</sup> Space limits not allowing more than cursory remarks on this point, the interested reader may refer to my "Die Genossenschaft und ihre Preispolitik," Karlsruhe: C. F. Müller, 1955, pp. 84-165.

and revenue curves, and (2) even if they are they do not behave in conformity with that information because of the presented capacity problems and computation problems.

All efforts of management towards securing profit maximizing output according to (1) in spite of these difficulties, must finally and as a rule be wrecked because of members' behavior as quantity adjusters, or because of institutional traits in cooperation.

## MORE ADO ABOUT SARLES' SUPPOSITIONS REGARDING THE INTERSTATE MANAGERIAL STUDY

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THE READER is referred to our previous rejoinder to Sarles' first statement.<sup>1</sup> From that rejoinder, we clarify and reiterate: (1) he is inadequately informed about the study, (2) his comments are premature in that they often deal with what he thinks we will do in the future, (3) his comments are often inaccurate in that they continue to be based on *his conceptions or suppositions* as to our purposes, reasons, and acts rather than our *actual* purposes, reasons and acts, and (4) his eagerness to judge prematurely on a scanty factual basis indicates a departure from scientific and academic procedures not expected from an experienced scientist employed in an organization recognized as outstanding.

While the truth of three of the above statements should be evident in Sarles' first statement, our previous rejoinder and/or in Sarles' own rejoinder, it remains for us to establish the inaccuracy of certain comments in his rejoinder. Specifically, nonagricultural economists, at well as agricultural economists were used as interviewers. We wonder if Sarle knows the proportion of agricultural economists among the interviewers and how much economics was known even by those interviewers with an interest in the field? Not all socio-economic survey research should be based on a strict probability sample, i.e., it is often desirable to select observations on the basis of the values of certain independent variables rather than by chance. Interviewer training schools can "begin to affect those questions that are directed toward a higher level on the abstraction ladder than many of the respondents . . . are accustomed to thinking." Any teacher knows that abstract ideas can be explained and that one can get a long way with such explanations. It is not necessarily true that "when questions are so involved that they require explanation by the interviewer, various interpretations are inevitable, which are a *source of bias*." Ob-

<sup>1</sup> *Journal of Farm Economics*, February 1956, pp. 163-167.

viously, good interviewer training could prevent variation in interpretation. More importantly, however, *bias would not result from random variations in interpretation.*

Perhaps, the most distressing aspect of Sarles' comments, from a scientific point of view, is his implication that the building of theories is *not* a reason for considering a study "extremely successful." Almost equally disturbing, from the same point of view, is his apparent increasing willingness to substitute "appeal to authority" for facts about the project as it becomes obvious that he is short of facts about the study.

#### *Our Position and Plea*

Of course, our noting of shortcomings in Sarles' criticisms does not inform the reader about the real strengths and weaknesses of the interstate managerial study. In this connection we should like to state that (1) we have been aware of many of the dangers stressed by Sarle since early in the design of the study, (2) we have taken many positive steps to avoid these dangers, (3) we have succeeded in avoiding these dangers in some instances but not in others, the pattern of successes and failures bearing at best only a vague relationship to the degree to which we followed, *ex ante*, Sarles' suggested methodologies, and finally (4) we are trying to analyze the data so that no unjustifiable conclusions are reached as a result of failures in the questionnaire.

We now request members of the profession to await our analysis, interpretation and publication of results before accepting Sarles' evaluation of the study. In short, we do feel a need for some "protection" against premature hasty "evaluations on the basis of *conjectures* about what may have been done in the past and will be done in the future" rather than "on the basis of what has been done to date."

### USING THE SIMPLEX WORKSHEET FOR LINEAR PROGRAMMING

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A very helpful article<sup>1</sup> explaining the mechanics and logic of the simplex worksheet method of linear programming has been contributed by Earl O. Heady. There are, however, two minor points, clarification of which may assist those using the worksheet in mechanical fashion.

<sup>1</sup> Earl O. Heady, "Simplified Presentation and Logical Aspects of Linear Programming Technique." *Journal of Farm Economics*, December 1954, pp. 1035-1048.

Both points relate to the R column of the simplex worksheet. The ratios in this column indicate, for each matrix, the quantity of the relevant product that could be produced by each resource (assuming supplies of other resources to be nonlimiting.) The smallest ratio indicates the resource or product to be replaced in calculating the next matrix. Not specified by Heady is the fact that in comparing these ratios *absolute* values are considered, the sign of the ratio being disregarded.

Also not mentioned explicitly is the point that ratios relevant to products as well as to resources must be considered in the comparison of absolute values. It is possible for one product to replace another from the matrix in the same way as resources are replaced by products in the examples given.

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## BOOK REVIEWS

*Agricultural Equipment Financing*, Howard G. Diesslin, Occasional Paper 50 of the National Bureau of Economic Research, Inc., New York, 1955. Pp. xvi, 95. \$1.25.

This study was conducted under the auspices of the National Bureau of Economic Research. It traces the development of farm credit practices since the early 1930's with some information going back as far as the early days of McCormick's reaper. Most of Dr. Diesslin's information has been drawn from surveys of machinery dealers, machinery manufacturers, and Production Credit Associations carried on by the NBER; a survey of farmers by the BAE in 1948; and a 1947 sample survey of insured commercial banks.

It is clear that manufacturers have pretty much left the field of financing farmer purchases, although they were still the main source of financing dealer inventory credit in 1954. The study shows that, in 1935, manufacturers received farmers notes equal to about half their sales; by 1944 they were almost completely out of the credit field. On the other hand, banks, which have been considered to be conservative in their financing of new products, have greatly increased their lending activity in the farm equipment field. Diesslin states that, by 1948, 45 per cent of commercial banks in the U. S. were making direct loans to farmers for equipment purchases, and the BAE survey of farmers showed that 48 per cent of their credit for purchase of farm equipment was obtained from banks.

Regional differences in total credit for equipment purchases and in the sources of credit are noted in this bulletin. Also, there is information with respect to interest rates, down payment provisions, and method of loan repayment. Dr. Diesslin has also gathered fragmentary evidence concerning losses sustained by four manufacturers on credit issued to farmers from 1935 to 1948.

The avowed objective of this study is to survey credit practices in the field of agricultural equipment financing. In this respect, Diesslin has done a thorough job. Background information presented will be of interest to people working in the field of farm credit. However, very little analysis is done on the reasons why regional differences exist for various credit practices and experiences. This would surely be a worthwhile investigation.

It seems that an attempt might have been made in sampling and in the analysis to get at the variability of the estimates. Only means are reported. This reviewer was somewhat disturbed by the lengthy discussion of the relative merits of one survey or sample compared with another

in regard to estimates of total credit and regional distribution of credit sources. Had Diesslin determined variability, he might have been better able to locate reasons for apparent differences in estimates.

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*Becoming a Farm Owner, Is It More Difficult Today?* Frank D. Hansing and W. L. Gibson, Jr., Virginia Agricultural Experiment Station Bulletin 473, Blacksburg, Virginia, 1955, Pp. 34.

The authors of this bulletin have attempted to determine for a two-county area in Virginia how initial capital investment in farms is acquired, how the method of capital acquisition is related to capital accumulation, and the effect of farm size, size of initial investment, age and education of the operator, and soil productivity, on the farmer's success in obtaining full ownership. Unfortunately, the title of the bulletin is somewhat misleading. No real evidence is given concerning the question, is it more difficult today? The title would have been more appropriate had the question been omitted.

Nearly two-thirds of the 160 farmers interviewed had some type of family help in obtaining initial ownership of their farms. Of those who acquired farms without family aid, 55 per cent obtained funds from non-farm employment; the others ascended the agricultural ladder or received purchase loans equal to 100 per cent of the purchase price. The authors compare initial investment, farm size, education, etc. between those who had family help and those who did not. Some differences are noted with respect to these variables, but for the most part, they are not significant.

The major finding appears to be that economic conditions are mainly responsible for success of farmers in accumulating capital once they have acquired initial ownership. More capital was accumulated per year by those farmers who became owners in the 1940-51 period than by those farmers who became owners in the 30's. The authors used a capital accumulation opportunity index as a variable in a regression to explain total capital accumulation. The index reflects time on the farm and economic conditions during these years. Other variables were included in the regression, but only the index of economic conditions and soil productivity gave significant "b" values. These two factors, however, explained only 39 per cent of the variability.

Many questions could be raised about specific points in this bulletin. I shall mention only a few. The use of a regression was worth a try, but the results are somewhat odd. Soil productivity was included as a linear term and raised to the three-halves power. Why soils to the three-halves power is used as a variable is not explained. The authors state that

higher soil productivity resulted in greater capital accumulation. However, the regression equation shows that soil of the lowest productivity rating contributes more to capital accumulation than soil of the next higher class. Also, according to the equation, soils of average productivity increase capital accumulation by about \$1,600, if my calculations are correct, above the soils of lowest productivity; the bulletin states that there is a \$6,000 difference between the two soil groups.

The authors suggest that the management factor does not seem to be too important as a determinant of capital accumulation. But, for farmers starting during the same years, there is a large variability in annual capital accumulation. This factor and the fact that a large proportion of the variability is unexplained by variables used suggest that management could be quite important. Also, the authors state that managerial decisions are less important in good times than in bad. No evidence is presented that would suggest this conclusion.

Although I do not disagree that it may be easier to acquire initial ownership of a farm in more prosperous periods, evidence to support this position is shaky. Since more farmers interviewed in 1952 bought farms in 1940-51 than in 1930-39, the authors state that this is evidence that it is easier to buy a farm in high employment times. The conclusion may be valid; the reasoning is not. One should be careful of such logic since the farther back in time one goes, the more likely that a person who bought a farm in that period will be dead or retired.

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*Money at Interest*, Allan G. Bogue, Ithaca, New York: Cornell University Press, 1955. Pp. 293. \$4.00

The book, in the opinion of this reviewer, is an outstanding contribution to the literature dealing with farm finance in the 1860-1905 period. It deals with the methods of getting money from the small and large savers of the Eastern United States and England into the hands of farmers in Illinois, Iowa, Kansas, Nebraska, Dakota territory and Texas. In the case of two specific townships, one each in Nebraska and Kansas, it gives a history of the disposal of government and railroad land according to year and size of tract and of the mortgages that were filed against the land in each township by years, classified as to whether the mortgagee was a nonresident or a local resident.

Extensive data are presented as to interest rates that were current in the last half of the 19th century as regards the amount written into the mortgage contract but does not give complete data as to commission rates that were paid by the borrower to the local agent. In general, interest rates varied from 12 percent plus generous commissions in the

early part of the period down to 6 percent plus commissions at the end of the period. Two phases of farm real estate financing of the period that come in for only incidental mention are the lending operations of life insurance companies and of local banks.

Teachers of farm finance will find this book excellent for assigned readings with a view to giving students the contrast between the past and present in farm finance. The book is well documented and includes an extensive bibliography.

The book consists of an introduction and three parts:

*The introduction:*

The introduction discusses the problem of the Western farmer between the 1860's and 1900 from the standpoint of capital needed and related problems. Even though he obtained his land as a homestead, the homesteader had need of horses, tools, buildings, fences and a well, and it took both time and money to get the prairie sod into cultivation. The author quotes data from several sources which lead to his conclusion that the minimum cash investment for converting 160 acres of bare prairie land into a farm was about \$1,000 plus the price of the land, if purchased.

In addition to farmers, there were speculators who were eager to use the funds of others to carry their holdings until they could sell them.

Then too, soon began the transfer of land from one farmer to another and from one generation to the next, which also required the aid of the money lender.

*Part I:*

Part I deals with the Eastern investor as illustrated by the records of John and Ira Davenport of Bath, New York, who administered investments for themselves and for related interests. The source material for the Davenport story is largely the Davenport Collection, Collection of Regional History, Cornell University, Ithaca, New York.

The extent and location of the activities of the Davenports is indicated by the following summary of loans made, beginning with 1868.

State or territory	Period	Number of loans	Amount	Prevailing interest rates <sup>a</sup>	No. of farms acquired
Illinois	1868-1902	1,379	\$2,583,317	6-10%	20
Iowa	1868-1880	878	553,745	10	65
Dakota territory	1878-1880	140	44,068	10	32
Kansas	1868-1903	571	342,919	5-12	38
Nebraska	1871-1900	1,610	1,128,892	5-12	48
Total		4,578	\$4,652,941	5-12	203

<sup>a</sup> In addition, substantial commissions were collected.

In addition, a substantial business was done in Illinois from 1860 to 1868.

*Part II:*

Part II deals with the role of the middleman in getting funds from the Eastern United States and Europe into the hands of the Western farmer as illustrated by the activities of the J. B. Watkins Land Mortgage Company of Lawrence, Kansas and is largely based on the J. B. Watkins papers held in the Library of the University of Kansas, Lawrence, Kansas.

J. B. Watkins set up a loan business at Champaign, Illinois, about 1871. In 1873 he moved to Lawrence, Kansas, then a city of between 6,000 and 7,000, and set up business as the J. B. Watkins Company. In soliciting Eastern funds, he relied in large part on advertising in religious newspapers. When Watkins first moved to Kansas, he loaned at 12 percent, plus commission, and sometimes offered the Eastern investor a portion of the commission paid by the borrower. In the summer of 1875, Watkins claimed to be advertising in 100 Kansas papers.

The annual report of the New York State Superintendent of Banking reported that up to September 20, 1893, the J. B. Watkins Company had negotiated 22,607 loans for the sum of \$18,986,106 for 4,796 investors. As of April 1894, the same source reported that the Watkins Company owned more than 249,000 acres of land.

In 1894, the J. B. Watkins Company went into receivership.

*Part III:*

Part III gives by years a summary of all homestead applications, homestead final certificates, sales of railroad land and of mortgage recordings from the beginning of settlement through 1905 in each of Pebble Township, Dodge County, Nebraska and Kinsley Township, Edwards County, Kansas. The data on mortgage recordings give number, acres involved, interest rate and whether or not the mortgagee was a resident of the county.

The Nebraska township is in an area of good quality loessial soil in eastern Nebraska. The Kansas township is between the 99th and 100th meridian and has yields that are about 88 percent of the state average.

In Pebble township, the odd numbered sections were in the land grant of 1864 to the Union Pacific Railroad and in Kinsley township, the odd numbered sections were in the land grant made to the Atchison, Topeka and Santa Fe Railroad in 1863.

In the case of Pebble township, 9,400 acres of the 11,441 acres of railroad land were sold in 1870 and 1871 in 19 parcels. Of the railroad land, John and Ira Davenport of Bath, New York, previously mentioned, ac-

quired 6,678 acres. In all, the Davenports purchased about 18,000 acres in Dodge County in 1870 and 1871 at \$5.00 to \$7.00 per acre. The Davenports sold their Pebble township lands to 81 individuals. Most of the purchases were made in 40 acre units and it was common for the same purchaser to buy several tracts over a period of 10 to 15 years. Only two purchasers of Davenport land in Pebble township defaulted on their contracts.

The Kinsley township railroad lands were sold between 1873 and 1898 at \$1.25 to \$10.00 per acre. Of 116 purchasers, 61 completed their contracts.

The data on mortgage recordings by years indicate that in each of the two townships, a relatively small percentage of the land was mortgaged soon after acquirement of title.

Data are given as to the amount of land under mortgage in each township by five-year intervals, 1870 through 1905.

In Pebble township on January 1, 1900, 6,672 acres were under mortgage, the largest amount at any of the five-year intervals. The 6,672 acres were 29.5 percent of the township area.

In Kinsley township, the highest amount under mortgage was in 1905, when 21 percent of the acres in the township was under mortgage. Up to 1905, 23 percent of the Kinsley borrowers on recorded mortgages lost their land.

In the case of both townships, there is no mention of unrecorded real estate contracts. This reviewer suspects that in each township unrecorded real estate contracts, if records were available, would have somewhat decreased the percentage of land with an unencumbered title, but in any case, the amount of land under mortgage at any one time is much less than would be inferred from some of the popular accounts of the agrarian troubles of the 1890's.

W.M. L. CAVERT

*Farm Credit District of St. Paul*

*Planning for Successful Dairying in New England*, Richard G. Wheeler and John D. Black, Cambridge: Harvard University Press, 1955. Pp. xii, 321. \$5.00.

Ten years ago a study looking toward improved management of New England dairy farms was launched by Harvard University in cooperation with the agricultural experiment stations and extension personnel of the region. The study was financed by the Charles H. Hood Dairy Foundation of Boston, and S.C.S., P.M.A. and other agencies assisted with some phases of the project. The approach to the task was to work with a large group of dairy farmers in making detailed plans for future operation of

their businesses and to observe their progress in achieving planned goals. Wheeler and Black's book is a largely nontechnical summary of the planning methods employed, the experience of farmers who cooperated in the study, conclusions regarding opportunities for improved management of the region's dairy farms, and implications for the future of dairying in New England.

The book contains little that is distinctly new in the way of methodology or in general recommendations for improvement of dairy farming. It is, however, an imposing demonstration of successful, realistic farm planning and of the progress that operators in many different kinds of farm situations can make by sticking to sound plans. The study was large and included a wide variety of conditions; progress of the majority of the farmers over a three-year period was impressive; changes were generally consistent with planned goals; and although one may differ with the authors on some minor points, the validity and effectiveness of the kind of farm planning they describe are convincingly shown. Conducted in New England, the demonstration has meaning for agricultural economists everywhere, and those engaged in farm and home planning will be particularly interested in it.

A total of 241 full-time or potentially full-time dairy farmers representing a wide range of farm situations participated in the study. Expected results of alternative plans were worked out by comparative budgeting for each farm, and the operator selected the one that best suited him. Plans were made in the years 1946-1948; progress was measured about three years later. Research applicable to the New England area was heavily drawn upon in the budgeting process, but only two input-output relationships are specifically given in the book. The authors emphasize their use of the operating unit approach, by which they mean that individual management decisions are considered within the context of the whole farm business and the physical resources available. Consideration of the operating unit is also their first step when they take up regional implications of the study.

One hundred forty-six of the farmers, the "progress" group, made substantial changes in the direction of planned goals during the three years. Figured at long-range planning prices, their average net income was \$2,710 when the study began, was expected to be \$4,500 on the completion of plans, and had reached \$4,060 at the end of three years. Thirty-five no-progress farms incurred an average decline in net income of about \$600 in three years. The remaining 60 farms were so affected by major changes in circumstances that the authors did not consider a direct comparison between the beginning and ending situations warranted.

Some readers may be inclined to think that the criteria for classifying

farms show the results in slightly too favorable a light. For example, farmers who had the bad luck to lose important farm labor were put in the group "affected by major changes in circumstances." Farmers who through good luck kept or gained important farm labor were left in the progress group. The appraisal of prospects for dairy farmers neglects the likelihood that most future technological developments, not now foreseen in detail, will increase the optimum size of farm. Thus the outlook for what is now a one-man farm may be less favorable than implied. A current example of a technological change having this tendency, bulk milk assembly, is not mentioned. On the credit side is considerable attention to work in industry as an alternative to farming. This topic complicates the analysis, but the authors have not followed the easy course of ignoring it.

Use of the operating unit as a first step in an appraisal of the future of the region's dairying requires that prices assumed in planning farm adjustments also are the prices that clear the market of anticipated production after adjustments have been made. The authors believe that this condition is reasonably well satisfied. They study historical data in an attempt to measure supply responses to price in New England dairying but have little more success than other investigators have had. Their expectations for the next ten years depend on over-all price relationships and off-farm employment opportunities. For the "median" situation, they look for fewer dairy farms, larger herds, higher production per cow, and perhaps a 7 or 8 per cent increase in total milk production.

Although agricultural economists are likely to be most impressed by the large-scale demonstration of farm planning in action, the book will be highly valued in New England for its comprehensive discussion of dairy farm management problems as they exist there. Dairymen can read this book, and the numerous examples drawn from typical farm situations make it particularly meaningful to anyone who wishes to apply it directly to a real farm.

G. E. BRANDOW

*The Pennsylvania State University*

*Uses of Agricultural Surpluses to Finance Economic Development in Under-developed Countries, a Pilot Study in India*, Food and Agriculture Organization of the United Nations, Commodity Policy Studies No. 6. Rome: Food and Agriculture Organization, June 1955. Pp. v, 65. No price.

Proposals have been made repeatedly that the embarrassing plenty of agricultural surpluses be used to raise food consumption and promote economic development in underdeveloped countries. This report of the

Food and Agriculture Organization makes the implications of these proposals more specific by analyzing the opportunities and problems that would arise in the use of surplus food. The study was carried on by an FAO team under the direction of Mordecai Ezekiel in consultation with economists and government planning officials of the Republic of India.

In using surplus food for economic development, three types of problems need to be analyzed: (1) investment activities that could benefit from the program have to be selected, (2) administrative procedures for distributing the food have to be developed, and (3) the effect on the whole economy has to be analyzed. The second of these topics is not treated in this report but could well be the subject of a valuable complementary study. Considerable experience in distribution of government stocks of food is available, and special devices like the food stamp plan seem applicable to some of the uses of surplus food suggested in this study.

The FAO study makes a valuable contribution in its treatment of the other two topics. The report analyzes in detail the effect of the availability of surplus food on Indian development projects. A variety of suggested projects can be undertaken on the basis of food distributed in kind. These include food scholarships to help youths attend high schools and colleges and to provide on-the-job experience for unemployed high school and college graduates, the use of food in village development projects carried on by the villagers, and milk marketing schemes in large Indian cities that could utilize surplus feed crops, nonfat dry milk solids, as well as surplus food for the consumption needs of the employees of the scheme.

However, the sale of surplus food and the payment of project wages in cash is better suited to most investment projects. In this case the effects of both the increase in investment and the availability of surplus food are diffused through the whole economy of the developing country. These effects, measured in monetary rather than in real terms, are analyzed in considerable detail by the use of the Keynesian income multiplier. Increases in the output resulting from the investment are also calculated by the use of output-capital ratios. This analysis makes clear that additional investment depends on the availability of other goods and services besides food, so that these also may have to be provided from foreign sources. The degree to which the proceeds of the sale of surplus food will cover the cost of additional investment activity is shown to depend on the following variables (pp. 8-10, 54-60):

- (1) project outlay for wages,
- (2) domestic purchases made by the project,
- (3) the marginal propensity of the project workers for surplus food,
- (4) the marginal propensity of the rest of the population for surplus food,

- (5) the marketing services needed to supply food to the project workers,
- (6) the marketing services needed to supply food to the rest of the population, and
- (7) tax rates and marginal propensities to save and to import.

The almost exclusive reliance on the Keynesian income multiplier defined in monetary terms is both a strength and a weakness. This concept is quite useful in combination with consumer budget data for tracing out the income and expenditure flows throughout the rest of the economy. But the language of Keynesian analysis leads to some conclusions that appear unnecessarily paradoxical. Thus the use of surplus food has to be treated as a "leakage" and it has the consequence that a given outlay of investment funds has a smaller (dampened) multiplier effect on national income than if surplus food had not been available. Under Indian conditions it is estimated that \$100 million in additional investment projects will raise national income by \$385 million, while in the case where surplus food is used, the same additional investment will raise national income by only \$161 million (pp. 14, 55-57). When this is translated into other economic concepts, it is equivalent either to a difference in the degree of inflation, or to a contrast between a country in which no further economic development is possible without the availability of surplus food and a country where resources are more bountiful. In a country of more abundant resources the increase in national income includes the increase in investment, the increase in food production and other production increases stimulated by increased economic activity. On the other hand, in a country that needs surplus food for additional development, the increase in the national income will not include an increase in the production of food. The same criticism applies to the discussion of the relation between the proportion of foreign financing of investment project costs and the proportion of these costs that will be borne by surplus food (p. 10). However in this case the conclusion is more clearly related to the availability of resources.

The strategic problem in many underdeveloped countries is a surplus of some and a scarcity of other resources. Underemployed labor is common, and other underemployed resources may also be available. This FAO study suggests that in India increased textile output and increased volume of railroad transportation could be provided with little if any additional investment, but that increase in output of food is more difficult (pp. 10, 62). Additional investment and the production stimulated by it require various kinds of resources and create the demand for a variety of goods and services. Surplus food complements the resources of underdeveloped countries by meeting a large part of the created demand for consumption goods. But other resources not available in the

underdeveloped economy may be needed either for direct use on the development projects or in response to stimulated expenditures. These deficiencies, in turn, determine the need for financing from abroad in addition to surplus food.

In the opinion of the reviewer, this FAO report does not give adequate attention to the availability of resources needed for development. However, this criticism should not detract from the achievement of this interesting pioneer study, which represents a large step forward in the economic analysis of the use of surplus food for economic development.

DON KANEL

*University of Nebraska*

*The Agricultural Regions of the United States*, Ladd Haystead and Gilbert C. Fite, Norman, Oklahoma: University of Oklahoma Press, 1955. Pp. xx, 288. \$4.00.

This statistical exposition and problem analysis of the agriculture of eleven regions into which the authors divide the United States is the joint work of a well known agricultural journalist and an agricultural historian. It is crammed with statistics of acreage, production, value of crops and land, investment in farm machinery and number of livestock units, all graphically presented with the aid of numerous tables and dot maps reduced in size from the originals in the census of 1950. Familiarity with the current scene on which the senior author had previously written and willingness to predict or at least to discuss possible future trends and changes that may be expected enabled Haystead and Fite to produce for the general reader a useful and in places challenging analysis graced by effective illustrations. The study strikes home, for example, on the treatment of the dairy industry in the different regions and in recent changes, such as decline in consumption of butterfat and increase in production of milk and resulting marketing problems, familiar as these developments may be. The possibility of substituting an all-grass economy for the present reliance on concentrates is instructively considered.

Much of the material will appear trite to any student of agricultural economics. The numerous clichés will annoy and the comparison of agriculture in California and Arizona counties of three to five million acres with that in counties one-fifth to one-tenth as large elsewhere will create doubts. Too much nonsense is displayed about the "heartbreaking toil" and meager living that New England hill farms provided. Developing a farm on the New Hampshire hills was no harsher than the work in many parts of the West, and the first or even second generation farmer in New Hampshire did not do badly. They migrated when better land beckoned, carrying with them the experience, the education, the capital

and strong physique New England had given them. These were to make them excel elsewhere. American agricultural development has been both a selective and an exploitative process but it is to the exploitative process that attention is most frequently turned. Farm abandonment should be regarded in much the same light as we look upon discarded highways in the vicinity of modern throughways. Hill farms have served their purpose but do not qualify for the modern intensive and extensive forms of agriculture practiced on better and more level soils, hence they are abandoned.

Elsewhere there will be dissent. Grudging admiration is expressed for the work of the TVA in soil, forest and water conservation, but the absurd notion that all taxpayers must contribute to it and that it is guilty of "acrobatic bookkeeping" may be set down as prejudiced judgements. Few scholars would agree that the Homestead Act of 1862 was an "enormous historical error" or that its authors considered it a wise measure to apply to the interior basin and mountain country. The act was adopted as settlers were pressing into eastern and central Kansas and Nebraska and when there were still in government hands many millions of acres of land in humid regions. The heritage of the railroad land grant policy left far greater problems in land management for later generations to deal with than the Homestead policy, which was slowly adapted to sub-humid land use.

As an antidote to the abundant use of statistics the authors have clothed their ideas in a racy style that borders on hyperbole in the chapters dealing with the region beyond the one-hundredth meridian. Everything worthy of discussion in that western area is "fabulous" (most frequently overused), "tremendous," "greatest," "vast," "famous," "fantastic." Adjectival abuse is offset in places by striking sentences as: "There may be some good reasons for maintaining a big population of 'honest yeomanry' on the soil but economics is not one of them." Despite the plethora of statistics sufficient almost to overwhelm the prospective general reader and the adjectival abuse the book is well worth reading.

PAUL W. GATES

*Cornell University*

***Modern Marketing Dynamics and Management***, Harry W. Hepner, New York: McGraw-Hill Book Company, Inc., 1955. Pp. viii, 599, \$6.00.

"The No. 1 problem in our economic life today is distribution. The United States is in need of a marketing revolution that, in the second half of the twentieth century, will be comparable to the industrial revolution that has been taking place during the first half of the century. Indeed, we have no choice in the matter if we want to survive as a great nation."

Mr. Hepner presents this challenge in the opening paragraph of Chapter I. It is followed by consideration of a series of topics that are treated with a view toward developing in the student "some appreciation of the problems of management in regard to modern marketing, . . . a daily awareness of basic trends and influences that bear on marketing," . . . and an interest in marketing that transcends the ability of one text to instruct.

The book is divided into ten parts. Following a short introductory section, Parts II and III discuss trends that should be watched by marketing men, possible markets for products, and marketing research. Parts V through VII consider product development, packaging, pricing, channels of distribution, promotion, personal selling, and management responsibilities in marketing. The concluding two sections are entitled "Marketing as your Career" and "Sources of Information," respectively.

Hepner has written this book from the firm's eye-view of the problem of distributing goods. His approach is entirely pragmatic and oriented largely toward the problem of how a firm can market more of its product. There is an implicit assumption throughout the book that the firm is selling a differentiated product and that conscious choice exists with respect to such activities as pricing, channels of distribution, and methods of promotion and advertising.

Possible markets are discussed from the viewpoint of the firm looking for an outlet for its product. Pricing is viewed essentially as a reaction of the firm to an existing situation, which includes certain positive factors such as ownership of patents, product differentiation, etc., and certain negative or constraining factors such as consumers' habits with respect to acceptance of price categories, the activities of discount houses, price cutting by competitors, etc.

Nine chapters evaluate the advantages and disadvantages of reaching the buyer through a wide range of outlets, including merchant wholesalers, super markets, automatic vending machines and many others. Promoting, selling and merchandising are examined in considerable detail. The author includes numerous practical suggestions for those who are faced with the problem of developing these activities for the firm. He also includes an evaluation of the value of advertising, in which the conclusion is reached that "advertising makes mass production feasible and thus helps to bring down cost to the consumer." This is followed by a lengthy quotation from an article credited to "Advertising Agency, April, 1953," in which the author of the quoted article states that the effect of advertising on living standards is interestingly revealed by the relationship between present-day living standards in England and the United States and the relative expenditures on advertising in each country, and between the increase in expenditures on advertising in the

United States from 1914 to the present and the change in living levels that has occurred. The relevancy of these correlations is unchallenged.

In general, the pragmatic approach taken by the author has resulted in a disjunctured evaluation of numerous specific marketing problems that firms encounter and the methods that have been or could be used in their solution. The broader implications of market phenomena as they relate to price formation, income distribution and the allocation of goods and services are untouched. The greatest use for this book will probably be found in schools of business administration and in departments of marketing which include courses related to the merchandising problems of the firm. It will have little value as a text or as reference material in marketing courses developed around rigorous economic analysis of market phenomena.

VERNON L. SORENSEN

*Michigan State University*

*Marketing Efficiency in Puerto Rico*, John Kenneth Galbraith and Richard H. Holton in collaboration with Robert E. Branson, Jean Ruth Robinson and Carolyn Shaw Bell. Cambridge: Harvard University Press, 1955. Pp. xi, 204. \$4.50.

The authors "present a comprehensive study of the marketing of food and other important products of everyday use in the Commonwealth of Puerto Rico" (p. 1). Their purpose is to describe the present organization of marketing and to compare its structure and costs with a model system. The description derives from a comprehensive sampling study of retailing and wholesaling made in 1950-51.

The size, operations, selling and buying practices, costs, and margins of food retailers are described in considerable detail. Food retailing in Puerto Rico is a residual occupation. Easy entry into retailing has led to an industry with some 14,000 grocery stores with a median net monthly return (including imputed wages) of less than \$28 per store. A survey of management practices and attitudes reveals a strong belief in single-proprietorship operation and a live-and-let-live attitude toward competitors. Both beliefs discourage price competition and even profit maximization itself, though various forms of nonprice competition occur. The more efficient operators ordinarily do not sell below the price level reflecting the high margins of the less efficient. This places the more efficient in the enviable position of reaping large profits while priding themselves on their ethical conduct. The high distribution costs rest upon a populace with a median income per spending unit of \$518 in 1950.

Food wholesalers vary considerably in capital, volume of sales, expense

and net profit ratios. The average markup is about 15 per cent as contrasted with the 9 per cent markup on the mainland.

Having established that wholesale and retail margins are high by mainland standards, the authors construct a model of what margins should be. Cost curves are derived by estimating the costs and returns of several firms assuming their sales were increased 50, 100, and 200 per cent. Three budgets are constructed on the basis of alternative assumptions about credit and delivery services. Four different market area retail models are constructed to provide for variations in operating conditions. An optimum volume and its corresponding percentage markup are selected for each model. In every case the projected cost curves have only a decreasing phase. The authors' decision as to the optimum output on a decreasing phase of the cost curve appears somewhat arbitrary on occasion. However, the desire to prevent any possible underestimation of costs and markup in the model system is commendable. The authors estimate that the minimum annual savings with the model system could have been \$20-25 million for the 1949-50 food bill of \$175 million. This would have required a reduction of 80 per cent in the number of retail stores and of 50 per cent in the number of persons employed in food retailing. Slightly greater savings are foreseen if delivery and credit services were to be restricted.

The distribution of clothing, shoes, yard goods, appliances, hardware, drugs, furniture and furnishings is described. The ratio of total expenses to sales was not an inverse function of sales as was the case with food retailing. However, no comparative model system is developed. Presumably, it was not considered worth while.

The last three chapters are a lucid statement of policy recommendations. The authors recognize the social resistance to major change and the adverse effects on employment that would result from an immediate change to the model system. They advocate measures by which the small, high-cost retailers possibly can be gradually eliminated. Presumably, this solution will be more acceptable than it has been as applied to the American farmer. "Indirect measures" to achieve the desired end are buyer education concerning values and retailer education concerning efficient management and the profitability of less brotherly attitudes towards one's competitors. "Direct measures" include government encouragement of cooperative retailing and the entrance into the island of a mainland food chain.

Does food distribution cost too much is a question not yet adequately answered for the United States mainland. This reviewer believes that the writers have answered the question for Puerto Rico. The estimates of just how excessive are costs may well be quite inaccurate but the existence

of an excess has been amply documented. The merit of the study lies not in the cost estimation techniques—ingenious as they sometimes are—but in its scope. The main problem and its answer are kept clearly in the forefront.

The cost estimates, while substantiating the large potential economies of scale, are obviously imprecise. In general, the difficulties are explicitly recognized. In fact, the reader is burdened with a very detailed discussion of the estimation process. The cost estimates for wholesaling are the least satisfactory. Almost nothing was obtained concerning the current costs of double handling by wholesalers. The budget projections of wholesalers were rather uncertain and were divergent in slope and height; therefore, only the crudest sort of optimal unit could be defined. The possible savings from materially increasing the mean size and reducing the number of purchases by retailers apparently were not considered. Presumably, the possibilities for savings were so obvious that more costly estimation procedures were considered unwarranted. In many situations, more data and more refined techniques would be necessary.

In many ways, the book is a tribute to the influence of John D. Black. The emphases upon firm budgeting, integrated analysis of a whole marketing system, the importance of providing the community with information for making economic decisions, and the wisdom of moderate reforms are all Blackian.

V. JAMES RHODES

*University of Missouri*

*Rural Industries in the Australian Economy*, Ian Shannon, Melbourne: F. W. Cheshire, 1955. Pp. 150. 22s 6d.

In this slim volume Ian Shannon offers a critical appraisal of past economic policy in relation to Australia's rural industries as a preview to enunciating his own version of the policy that will achieve a more balanced development of the various sectors of the economy.

The book is divided into three parts. In Part I, the author examines the major rural industries, viz., wool, wheat (and flour), meat and butter, in detail since these have been the dominant factors in determining the nation's export income. Part II is given over to a description of how rural and other production has been affected by government policy in regard to such matters as exchange rates, tariffs, import restrictions and Imperial preference. In the author's words "all these different government policies have added up to restrict the growth of the rural industry: to draw Australian economic activity away from the region in which it is most efficient and towards producing alternatives whose value in relation to resources consumed is not as great as in rural industry" (p. 124). Hence,

Part III is devoted to an elaboration of "the best road" that should be followed by a country that is "at the cross roads."

The general reader will probably find that the most interesting sections of the book are those in which the author recounts the economic and political events that have influenced Australia's marketing policies for trade in the major commodities. In writing these paragraphs the author appears to be on fairly familiar ground. However, the rather confused nature of some of his theoretical expositions suggest he is on somewhat less familiar terms with the demand and supply structures for some commodities.

The statistical data used by Shannon do not, in this writer's opinion, offer a really adequate basis for generalisations about such phenomena as productive efficiency in rural industries and the expenditure patterns of farmers. Information on these and similar topics has now been gathered from field surveys carried out by various Australian research teams. Although some of this material has been analysed and reported upon, much more information of a specific nature can be expected in the near future.

As the field surveys were conducted by government and university groups one could not expect the raw material to have been available at Oxford University, where Shannon completed the research work on which the book is based. However, one might have expected him to show some awareness of the significance of alternative approaches to the problems he has examined.

Readers in foreign parts may note with curiosity the publisher's description of Ian Shannon as "one of the few trained agricultural economists in Australia." For the benefit of overseas colleagues one feels obliged to point out that, although agricultural economics is not a flourishing profession in the Commonwealth of Australia, there is a respectable number of trained men employed here. Not unnaturally, some have better training than others but all have some degree of training.

The essence of Shannon's solution is that import restrictions and tariffs should be removed and the Australian currency devalued "on a scale sufficient to raise the profits from rural production while lowering those in the import-competing industry (as a whole)" (p. 132). In Shannon's view this policy would ultimately lead to the point where "the overseas value of Australian currency could be appreciated upwards with the resulting expansion of export production and international reserves combined with a conjoint fall in the domestic cost structure" (p. 136).

Australians receive frequent reminders, by way of import and credit restrictions, of the defects in the pattern of national development. A

critical examination of the country's economic policy is, therefore, always welcome. However, the issues involved in any such examination are highly controversial. One cannot expect unanimity of opinion as to proposed solutions and Shannon, like his mentor Colin Clark, issues his conclusions with such conviction as to almost challenge the neutrality of the reader. This probably heightens interest in the book for the layman and the student. Professional economists are more difficult to satisfy and many will doubtless wish that the author had reported his various statistical analyses in greater detail.

LEO C. YORKE

*Department of Agriculture,  
N.S.W., Australia*

*Income of the American People*, Herman P. Miller, New York: John Wiley & Sons, 1955. Pp. xvi, 206. \$5.50.

As the title suggests, this is a book about people and their income in America; but it is concerned with much more than personal income per se. It deals with personal distribution of income and seeks to analyze the factors responsible for the characteristic shape of the distribution curve (heavily skewed to the right.) It also examines changes in the distribution of income over time.

The principal tool used in the analysis is the concept that connects income earners with the sources of their income—*occupations*. The analysis of income by occupations is a thread that runs through the whole book, and it explains much. But it also raises some questions! If as a reviewer I am constrained to criticize, my principal criticism would run along the following lines: data are useful not only to check hypotheses but also to suggest hypotheses; one wishes that the author had been less reticent about striking out with bold hypotheses about his subject matter. The author is an experienced census man working with his own census data and even special tabulations of those data. Moreover he is well versed in the professional literature on the personal distribution of income. Who would be better qualified to erect bold new hypotheses? But I suppose he was afflicted with a disease that characterizes good statisticians—an excessive humility concerning the quality of his data and their capacity to provide definite answers and suggestions.

Having said that, however, let me hasten to recommend the book highly. A number of very important hypotheses about income distribution are carefully checked against the data and some significant conclusions are drawn. The book is certainly a welcome and refreshing antidote to those theorists or social ideologists who erect theories of personal distribution of income without really consulting facts. The book is a *must* for "reformers"; it may puncture some of their favorite ideas, but it also may give them some new ammunition.

I. The first hypothesis that is analyzed might be formulated something like the following. Abilities and talents have biological origins, and biological characteristics tend to be "normally distributed" (using the term in its statistical sense). If abilities and talents in economic activity were rewarded according to their intensity, then incomes should also be "normally distributed." But they are not; the distribution of income is skewed heavily to the right. *Ergo* someone is exploiting someone else and someone is being discriminated against.

In answer to this theory there is offered a counter explanation that runs something like this. Income recipients are not economically homogeneous; they are divided into many categories that have essentially different economic characteristics, and within those categories incomes of individuals *are* distributed normally. It is this latter hypothesis that the author checks, and he finds a good deal of validity in it.

Women, part-time workers, farmers, and service workers and laborers all contribute to the asymmetry of the over-all income curve, but some of them (like fully employed women) have symmetrical income distributions within their respective classes. Be that as it may, three-quarters of the employed men fall into three classes—"blue-collar workers"; "white-collar" workers; and independent professionals, nonfarm proprietors, and managerial workers. Each of these three classes has an income distribution that is roughly symmetrical. But these occupational classes have different levels of income; most of the highest income recipients were in the class of independent professionals, businessmen, and managerial workers. Much of the skewness in the over-all income curve can be explained by the different levels of income for the various occupational classes, and the differing numbers of people who make up those classes.

So far so good. But several questions immediately present themselves. Why are the average incomes in some occupations higher than in others? And why are the numbers of people in some occupations larger than in others? The author recognizes the pertinence of these questions and considers them at some length, but the reader is left with the unsatisfied feeling that no very forceful hypotheses were presented.

II. Next the author examines differences in personal income by size of community and by region. He finds evidence that one popular impression is by no means the whole truth—that is the idea that large cities are places where vast numbers of unskilled workers are concentrated. A more significant characteristic of large cities (from an income standpoint, at least) is the fact that they offer employment opportunities in high paying occupations that are not available in small communities and rural areas. And a larger percentage of the labor force in the big cities are working in the higher paying occupations. Hence the average income is higher. This is especially true for nonwhite men and for women, which opens

interesting possibilities for theories of occupational mobility and discrimination in large cities versus small communities.

Unlike income differences for cities of various sizes, the author finds that income variations by *regions* do *not* seem to be associated with different occupational structures. Quarreling somewhat with work done by D. Gale Johnson on this subject, the author finds that incomes of white males in cities of the same general size differ considerably among regions. Some hypotheses are presented to explain this, but again the reader is left with an unsatisfied feeling.

III. Taking a closer look at detailed occupations, the author attacks the idea that unskilled workers form the broad base of an occupational pyramid in the labor force. He finds that a more characteristic feature of it is the great concentration of workers in the semiskilled, skilled, and "white collar" occupations. He also finds considerable stability over time in the ranking of occupations by income. And there also seems to be some evidence of an upgrading in the occupational distribution of the labor force over time.

These are very significant facts for theories of both income distribution and economic development. One can see possibilities of weaving them into quite a general theory of a type that is sorely needed, but the author doesn't provide much help in that direction.

IV. Quarreling a bit with Margaret G. Reid, the author finds that the distribution of income changed quite significantly between 1939 and 1951. Most of the change occurred between 1939 and 1944; since the latter date income distribution has remained quite stable. Of course the change in the 1939-44 period was toward greater equality—"less inequality" might be a better term.

Given that fact, an argument of interpretation arises. One group of people—generally of "reforming" persuasion—holds that the more equal distribution of income is a great bulwark supporting full employment and prosperity. To ensure continuation of full employment they argue for policies leading to a still more equal distribution. A different group—generally of a more conservative persuasion—argue that the causation runs the other way, that full employment leads to a more equal distribution of income.

The author's data suggest that for the 1939-44 period the latter group of people have the better part of the argument. On the basis of the evidence, it would be difficult to argue that prosperity was achieved during that time through a sudden exogenous change in income distribution. But it is reasonable to argue that the prosperity came from exogenous sources and that the distribution of income changed as a result of it. (Of course, this is not to say that the continuation of the lesser de-

gree of inequality achieved by 1944 has not been an important influence tending to sustain full employment in the period since then.)

The more equal distribution of income was achieved by means of the lowest paid occupations making greater relative gains in income than the highest paid occupations. And there was a decrease in the dispersion of incomes within all major occupations (except laborers). Both of these results seem to be related to a general narrowing of wage differentials as well as a reduction of part-time work.

It seems reasonable to suppose that this is the kind of effect that might be expected from the greater competition for workers which characterizes a full-employment situation compared with the partial-employment condition in 1939. And, in turn, this fits in with the idea that the classic "competitive model" (while still having some grave deficiencies) certainly gives a much better representation of actual economic interrelationships during a period of full employment than it does in a time of partial employment. I seem to recall John Maynard Keynes having said something like this on occasion, and that is the type of observation that made him a great economist despite glaring defects in the details of some of his theories.

To conclude this review, let me express the hope on behalf of the field of economics that more monographs will be forthcoming in which the author withdraws from the trees and takes a long hard look at the forest of census data in relation to important issues of our science. And let us hope that they meet the high quality standards set by this book of Miller's—only a little more theory please!

L. JOHN KUTISH

*Federal Reserve Bank of Chicago*

## LAURENCE JOSEPH NORTON, 1896-1956

**T**HE death of Dr. L. J. Norton brought to a sudden close a life devoted to constructive thinking and practical action pertaining to farm life.

Dr. Norton died at Urbana, Illinois, on February 3, 1956, following a brief illness. He was reared on a farm at Granville, New York, where he was born on May 7, 1896. On October 18, 1955, he was married to Aurene Taubman, who survives him. Dr. Norton was an active member of the Urbana Unitarian Church. His broad sympathies and understanding were such that his friendship was of deep value to many who came to know him.

He attended Cornell University, receiving his Bachelor of Science degree in 1917 and his Doctor of Philosophy degree in Agricultural Economics in 1921. He was in military service during 1918 and 1919. After a brief period on the staff of Cornell University, he came to the University of Illinois in 1923. He was engaged in both teaching and research, with special attention to marketing of farm products, agricultural finance, and agricultural policy. Since February 1, 1955, he had served as head of the Department of Agricultural Economics.

In 1933 Dr. Norton joined the staff of the Federal Farm Credit Administration. He helped to organize the Production Credit Corporation of the Farm Credit Administration and to establish farmers' production credit associations throughout the United States. During 1935 and 1936 he served as vice president and secretary of the Production Credit Corporation at St. Louis, returning to the University of Illinois in 1936.

In 1949, under the auspices of the United States Department of Agriculture, he made a special study of the market for fats and oils in Europe. Through this work and as a member of the International Conference of Agricultural Economists, he became known internationally as a leader in agricultural economics. His standing and leadership were further attested when he was elected vice president of the American Farm Economic Association in 1941 and president in 1945. He also served as secretary-treasurer of this association. Among his many committee assignments he served on the Agricultural Board of the National Research Council and the Committee on Economic Policy of the U. S. Chamber of Commerce.

Dr. Norton was regarded as an authority in agricultural economic matters by many friends who were engaged in college, agricultural, and business activities. His advice and criticism on economic problems were widely sought. He was author and joint author of two books and numerous bulletins, circulars, and articles.

He was widely read, a thorough student, and known for his direct manner of speech. He was a man of conviction, never leaving any doubt of his stand on controversial issues. He would not tolerate any compromise of principles, all of which made him widely respected for his forthright statements.

His greatest contribution, however, was as a teacher, especially of graduate students. He knew his students personally and understood their problems. He helped them become independent thinkers who could ably defend their position on controversial issues. In assisting them he left his mark of integrity with them. He demanded that they be direct and thorough in analyzing difficult problems, a requirement that they grew to appreciate more after leaving his tutelage. His many friends and associates have lost a good friend whose counsel they valued highly.

Presented by J. F. Bell, C. L. Stewart, H. C. M. Case

## NEWS NOTES

RONALD O. AINES was appointed Assistant Professor of Agricultural Economics and Farm Management at Rutgers University on January 16, 1956. Previous to this appointment he spent two years studying at Harvard University.

GEORGE BENNETT ALCORN was appointed Director of the Agricultural Extension Service at the University of California, Berkeley, California, effective March 1, 1956. Mr. Alcorn received his B.S. degree from University of California in 1936 and a Master's Degree in Agricultural Economics in 1937. Later, in 1955, he was granted a leave of absence to complete his work for the Ph.D. degree in Public Administration at Harvard University.

ANTOINE BANNA, an analytical statistician in the Statistical and Historical Research Branch of the Agricultural Economics Division for several years, transferred to the Gadsden Air Force Depot at Gadsden, Alabama, on February 6, 1956.

WALLACE BARR has joined the Agricultural Economics Staff of Ohio State University as an Instructor specializing in Extension Agricultural Policy and Outlook. He is continuing graduate study toward a Ph.D.

FRANCIS H. BELMONT was appointed to the State Statistician's Office of the Division of Agricultural Estimates at Sacramento, California on December 15, 1955.

WILLIAM S. BENNETT joined the staff of the Production Economics Research Branch, ARS, in January, reporting for duty at Shelbyville, Kentucky, where he will work on watershed problems. He comes to the Branch from the Bureau of the Census.

RICHARD L. BERE joined the Agricultural Economics staff at Ohio State University January 1, as Extension Specialist in food merchandising. He has completed most of his work toward the Ph.D. degree at Ohio State University.

JORIS W. BIEMANS returned to his home in Holland in December after 15 months of graduate work at the Food Research Institute, Stanford University. In July 1955 he was awarded a Council of Europe Fellowship for research on "Advantages of European Economic Integration with Special Regard to Agriculture," and is engaged in research and travel bearing on this project.

RONALD BIRD, Production Economics Research Branch, ARS, is now stationed at Columbia, Missouri, where he will work with Professor Frank Miller of the Missouri station on studies of low-income farming, and water utilization.

JOHN BLACKMORE, formerly with TVA, has been named as Executive Secretary of the Sub-Committee on Land and Water Use of the European Committee on Agriculture.

HOWARD L. BOSSART transferred from the Agricultural Estimates Division, State Statistician's Office at Springfield, Illinois, to the State Statistician's Office at Alexandria, Louisiana.

LAUREN H. BROWN has received a leave of absence from Michigan State University from February to October 1956. He will spend this time as consultant on farm work simplification in several western European countries for the O.E.E.C.

DAVID J. BURNS was appointed Associate Research Specialist in Marketing at Rutgers University effective February 1, 1956. Dr. Burns formerly was on the marketing staff at the University of Maryland.

GEORGE BYERS, University of Kentucky, has recently completed a tour of Far Eastern rice-producing countries for FAO, examining the possibilities of mechanization of rice production in these areas.

J. D. CAMPBELL, recently with the University of Arkansas and formerly with the Oklahoma A & M College where he received a M.S. degree has joined the staff of the Farmer Cooperative Service. He will work with the Cotton and Oilseeds Branch of that agency.

THOMAS F. CARROLL, of the FAO Rome staff, will spend four months at the University of California, Los Angeles, conducting a seminar on Latin American Economic Development.

HOMER L. CARTER transferred from the Bureau of the Census, U.S. Department of Commerce to the Agricultural Estimates Division, State Statistician's Office at Austin, Texas on December 5, 1955.

WILLIAM E. CATHCART has resigned from Kansas State College to accept a position in the Department of Agricultural Economics at Oklahoma A & M College.

FRED A. CLARENBACH has been placed in charge of the work on land problems in the Production Economics Research Branch, ARS. He is on leave from the University of Wisconsin where he has been Professor of Political Science.

E. F. DANIEL, formerly Extension Specialist in farm management at the University of Kentucky, has accepted a two-year position as Agricultural Production Economics Adviser with International Cooperation Administration. Mr. Daniel will be in New Delhi, India.

LLOYD H. DAVIS joined the Federal Extension Service staff on January 3 as Acting Chief, Fruit and Vegetable Marketing and Utilization Branch, Division of Agricultural Economics Programs. Dr. Davis has been at Cornell University as Associate Professor in marketing and for the last five years has served as Extension Specialist in marketing.

VELMAR W. DAVIS has been appointed to the staff of the Production Economics Research Branch of the Agricultural Research Service and will work at the University of Illinois.

ROBERT V. ENOCHIAN, of the Market Organization and Costs Branch, Marketing Research Division, has transferred from Berkeley, California, to Washington, D.C.

MERRILL B. EVANS resigned in November as Assistant Professor of Agricultural

Economics at Ohio State University to accept a position as a leader in price analysis with the Ford Motor Company.

PAUL J. FINDLEN, Research Director of the New York State Joint Legislative Committee on Imitation Milk Products and Problems, combined participation in the program of the Ninth International Conference of Agricultural Economists in Finland last summer with a study of European experience with Tetra Pak, a new Swedish paper package for milk. He visited dairies in Norway, Sweden, Germany, Netherlands, France and Switzerland in connection with this study. On invitation from the Commission on Dairy Economics of the International Dairy Federation, Dr. Findlen reported on the work of the Joint Legislative Committee at the Federation's annual meeting in Bonn, Germany, in September.

GLENN E. FISCHER transferred from the Bureau of the Census, U. S. Department of Commerce, to the Agricultural Estimates Division, State Statistician's Office at Springfield, Illinois, on January 3, 1956.

D. L. FLOYD, in charge of the Office of the State Statistician at Athens, Georgia, retired on December 31, 1955 with more than 33 years of service. Except for two years service in World War I and a year with the Bureau of the Census, he has been working on Crop Estimates work since 1924, when the office was at Atlanta. He moved to the Athens office in 1929 at which time he was placed in charge, succeeding Virgil Childs. He plans to remain in Athens, except for the summer months, which mostly will be spent in the mountains of north Georgia. Archie Langley is the new State Statistician for Georgia.

KIRK FOX, formerly Research Associate at the University of Illinois, has joined the staff of the Atomic Energy Commission in Washington, D.C.

LLOYD F. FRIEND has been employed by the Market Organization and Costs Branch, Marketing Research Division, to work on a study of farm-to-retail price spreads for fluid milk.

WYLIE D. GOODSELL, Production Economics Research Branch, ARS, returned to Washington on December 23 from an assignment with FAO. For the Division of Fisheries, FAO, he made an economic study of inland fisheries in Europe and the Middle and Far East, and lectured for 6 weeks at the International Inland Fisheries Training Center at Bogor, Indonesia.

W. SMITH GREIG, formerly an AMS cooperative agent at the University of Florida, has joined the Washington staff of the Market Organization and Costs Branch, Marketing Research Division.

ROBERT W. HARRISON has just completed an assignment for FAO, involving participation in a training center in Dacca, East Pakistan, and the preparation of a manuscript dealing with problems in the Economic Appraisal of Agricultural Development Projects.

RICHARD HARTWIG, Michigan State Agricultural Economist in the upper peninsula, will be on leave April to June 1956 to complete the requirements for a master's degree at the University of Chicago.

**BURNELL HELD**, formerly at Pennsylvania State University, has joined the research staff of Resources for the Future, Inc. at Washington, D.C. He is working on land use and management.

**CLIFFORD HILDRETH** has been granted two short leaves of absence from Michigan State University. The first in April 1956 is to teach mathematical economics at the University of Minnesota. The second in July is to teach linear equations in the Social Science Research Council summer research institute at North Carolina State College.

**HOWARD HILL** joined the staff of the Production Economics Research Branch, ARS, on February 1, as a cooperative employee of the Branch and the Wisconsin Agricultural Experiment Station, to work on a leasing study.

**SIDNEY ISHEE** has been appointed Assistant Professor in the Department of Agricultural Economics and Marketing at the University of Maryland, effective February 1, 1956.

**GLENN JOHNSON** has been granted leave of absence from Michigan State University for the summer of 1956. He will be working with the staff at the University of California in organizing and developing a teaching and research program in production economics and farm management.

**G. L. JORDAN** has been named Acting Head of the Department of Agricultural Economics, University of Illinois.

**JAMES R. KENDALL** transferred from the State Statistician's Office, Agricultural Estimates Division at Columbus, Ohio, to the State Statistician's Office at Springfield, Illinois, on January 29, 1956.

**JOHN O. KLING** joined the staff at New Mexico A & M College on June 1, 1955, as Extension Specialist in Fruit and Vegetable Marketing, and was appointed Acting Extension Economist on September 1. Kling received his B.S. degree in 1950 and his M.S. at Louisiana State University in 1952, and was a staff member there for one year. He was engaged in farming and ranching in Texas before coming to New Mexico.

**LEE KOLMER**, formerly at Southern Illinois University, joined the Iowa State College staff in January, 1956, as Assistant Professor of Economics. Dr. Kolmer's work will be in agricultural extension, and will deal with consumer information and food distribution.

**PAUL R. KULP** has joined the Washington, D.C. staff of the Production Economics Research Branch, ARS, to work on costs and returns.

**JAMES F. LANKFORD** transferred from the State Statistician's Office, Agricultural Estimates Division, Alexandria, Louisiana, to the Special Statistics Branch, Agricultural Estimates Division at Washington, D.C. on December 27, 1955.

**BUEL F. LANPHER, JR.**, has accepted a position as Extension Specialist in Agricultural Economics at the University of Kentucky, and will work particularly in the economic outlook area. He recently completed his requirements for the Ph.D. at Iowa State College.

**JAMES H. LEWIS** was appointed as Instructor in Agricultural Economics at Ohio State University on February 1. He was formerly employed by the Ohio Clover Leaf Dairy of Toledo, Ohio.

FRED F. LININGER, formerly Head of the Department of Agricultural Economics and Director of the Pennsylvania Agricultural Experiment Station, has been appointed Lecturer in Agricultural Economics at the University of Florida for the spring semester 1955-56.

T. WILSON LONGMORE died on January 22, 1956, at the University of Illinois Hospital in Chicago, after a long illness. Dr. Longmore was with the Bureau of Agricultural Economics from 1939 to 1953. When he became ill he was serving in India at the Headquarters of the Agricultural Institute at Allahabad, for the University of Illinois, but was returned to the United States in December, 1955.

ALMON T. MACE, who received his Ph.D. degree in economics from The George Washington University in February, 1956, has left the Farmers Home Administration national office staff to head the program analysis work on oils and peanuts with the Commodity Stabilization Service, United States Department of Agriculture, Washington, D.C.

WILLIAM M. MANION has transferred from the Agricultural Estimates Division to the Market Organization and Costs Branch, Agricultural Marketing Service. He is stationed at Minneapolis, Minnesota.

JAMES B. MARGRAVE was appointed to the Agricultural Estimates Division, Livestock and Poultry Statistical Branch on December 19, 1955. He was formerly employed by the Agricultural Research Service.

CLYDE MITCHELL, from the University of Nebraska, and George Mehren, from the University of California, have been in Rome during the spring of 1956 lecturing at a training center on Agricultural Economics, jointly sponsored by the Italian Government and FAO.

RICHARD R. NEWBERG joined the Agricultural Economics staff at Ohio State University in February as an Associate Professor. He will work mainly in the field of livestock marketing. Dr. Newberg was formerly at South Dakota State College.

RUSSELL O. OLSON has taken leave from the Production Economics Research Branch of the USDA to assume a full-time position as Associate Professor with Ohio State University. Olson left October 28 for two years in India with the Ohio State University's Agricultural College Mission. He will be stationed at Patiala, India where he will be developing Agricultural Economics work in local colleges in northern India.

WILLIAM G. O'REGAN, Associate Professor of Agricultural Economics at the University of Florida, has resigned to accept a position as Statistical Analyst for the Minute Maid Corporation, Orlando, Florida.

O. T. Oscood, formerly of Mississippi State College, was recently named as the 1000th agricultural expert employed by FAO in connection with its world-wide technical assistance program.

L. R. PARAMORE will leave the Federal Extension Service on March 12 after serving for ten years in the general crops marketing field, most recently as Chief, General Crops Marketing and Utilization Branch, Division of Agricultural Economics Programs. His new assignment is as Chief, Foreign

Marketing Branch, Cotton Division, Foreign Agricultural Service, where he will be concerned with market development work for cotton under Public Law 480 and other programs.

OLIVE PARRISH transferred from the regional extension consumer food marketing project at Cincinnati to the state project at Ohio State University. Mrs. Parrish was appointed as Extension Specialist in Agricultural Economics effective February 1.

JAMES E. PEARSON returned to the Department of Agricultural Economics at the University of Kentucky to do research in livestock marketing.

DAVID H. PENNY, a graduate student at the Food Research Institute, Stanford University, 1954-55, has been appointed Agricultural Economist with the South Australian Department of Agriculture, with headquarters at Adelaide.

WEBER H. PETERSON of the Foreign Agricultural Service (USDA) was a member of the U.S. Delegation to the Fourth round of tariff negotiations of GATT. These negotiations have been held in Geneva, Switzerland, beginning January 18, 1956.

WARNEY L. PICKERING, formerly with the Bureau of the Census, was appointed to a position with the Agricultural Estimates Division, in the State Statistician's Office at Des Moines, Iowa, on February 6, 1956.

CLAYTON H. PLUMB was appointed temporary Assistant Agricultural Economist at the University of Vermont effective February 1, 1956.

JULES V. POWELL has joined the Washington staff of the Market Organization and Costs Branch, Marketing Research Division. Mr. Powell was a Bureau of Agricultural Economics cooperative agent at the University of Hawaii in 1950. Before coming to Washington he was in business in Clarksburg, West Virginia.

FLETCHER E. RICCS has resigned from Kansas State College to accept a position in research with the Tennessee Valley Authority at Knoxville, Tennessee.

ARTHUR ROLLEFSON, formerly with the Market Organization and Costs Branch, Marketing Research Division, is now Assistant Agricultural Attaché in Tokyo, Japan.

STEPHEN SCHMIDT, formerly a graduate student at McGill University, is on a year's research appointment at the University of Kentucky, working on a project in agricultural cooperation.

A. D. SEALE, JR., who completed his requirements for the Ph.D. degree from North Carolina State College in June, 1955, has joined the staff of the Department of Agricultural Economics of Mississippi State College as Assistant Professor, effective January 1, 1956. Dr. Seale was previously employed as Extension Marketing Specialist in the Department of Agricultural Economics, North Carolina State College.

KARL G. SHOEMAKER joined the Federal Extension Service staff as Chief, General Economics and Rural Sociology Branch, Division of Agricultural

Economics Programs, on January 3, 1956. Mr. Shoemaker came from the University of Wisconsin, where he spent the past eight years as Dairy Marketing Specialist with the Extension Service.

MRS. JANET R. STANTON, social scientist in the Farm Population and Rural Life Branch, Agricultural Economics Division, resigned on February 24, 1956.

DONALD D. STEWARD accepted a position as Instructor in Agricultural Economics at Ohio State University in January. He has been assigned to a regional project on wheat price and income policy.

FREDERICK D. STOCKER, transferred on February 26, 1956, from the Production Economics Research Branch, ARS, to the Agricultural Marketing Service, where he will work in the Farm Income Branch.

ALEXANDER STURGES has been appointed to the staff of the State Statistician's Office, Agricultural Estimates Division, at Madison, Wisconsin on January 15, 1956.

STANLEY K. THURSTON, Jr., formerly with the Research Department of the Missouri Farmers Association, has joined the staff of the Farmer Co-operative Service, U.S. Department of Agriculture. He will work for the Grain Branch of the Service.

J. ROBERT TOMPKIN was appointed to the Production Economics Research Branch, Agricultural Research Service, and Assistant Professor of Agricultural Economics at Ohio State University January 1, 1956. Dr. Tompkin was formerly at Wyoming State College at Laramie.

ROBERT L. TONTZ has joined the staff of the Production Economics Research Branch, ARS, to work on water utilization problems. He came to the Branch from Oklahoma A & M where he had been Assistant Professor of Agricultural Economics since 1947.

THOMAS E. TRAMEL, previously employed by Virginia Polytechnic Institute as Professor of Farm Management in the Department of Agricultural Economics, returned to Mississippi State College as Agricultural Economist and Professor of Agricultural Economics, effective February 1, 1956.

ROBERT L. VOSSEN transferred from the State Statistician's Office at East Lansing, Michigan, on February 20, 1956, to the State Statistician's Office, Agricultural Estimates Division at Columbus, Ohio.

MRS. LOA WHITFIELD has been promoted to State Home Demonstration Leader of Ohio. She formerly was co-leader of the Consumer Food Marketing Extension project in the Agricultural Economics Department of Ohio State University.

ARTHUR W. WOOD, research assistant at the Food Research Institute, Stanford University, has been appointed Assistant Professor of Marketing in the Department of Agricultural Economics and Farm Management in the Faculty of Agriculture, University of Manitoba, Winnipeg. From September 1955 until assuming his new duties in January 1956, he served as economist in the Economic and Research Branch of the Canadian Federal Department of Labour, Ottawa.

## DEGREES CONFERRED AND GRADUATE STUDENTS IN AGRICULTURAL ECONOMICS

### *Ph.D. Degrees Conferred*

- MARVIN A. ANDERSON, B.S. Iowa State College 1939; M.S. Iowa State College 1949; Ph.D. Iowa State College 1955, Factors Affecting Acceptance and Use of Fertilizer on Iowa Farms.
- LESTER LOWELL ARNOLD, B.S. Ohio State University 1938; M.S. University of Wisconsin 1952; Ph.D. Purdue University 1955, Problems of Capital Accumulation in Getting Started Farming.
- JAMES WAYLAND BENNETT, B.S. Texas Technological College 1948; M.S. Louisiana State University 1951; Ph.D. Louisiana State University 1955, An Analysis of Beef Cattle Prices.
- RALPH ALBERT BENTON, B.S. University of Nebraska 1930; A.M. University of Nebraska 1940; Ph.D. University of Illinois 1955, The Illinois Broiler Industry.
- CHRISTOPH BERINGER, B.S. T.H. Munich 1950; M.S. Michigan State University 1953; Ph.D. Michigan State University 1955, A Method of Estimating Marginal Value Productivities of Input and Investment Categories on Multiple Input Farms.
- JAMES NEWTON BOLES, A.B. San Diego State College 1948; M.S. University of California 1951; Ph.D. University of California 1955, Economies of Scale for Evaporated Milk Plants in California.
- NELLIS AUSTIN BRISCOE, B.S. Kansas State College, Fort Hays, 1948; M.S. Kansas State College, Fort Hays, 1952; Ph.D. Oklahoma A & M College 1955, United States Agricultural Policies Affecting the Wheat Industry.
- WILLIAM G. BROWN, B.S. Kansas State College 1950; M.S. Iowa State College 1953; Ph.D. Iowa State College 1955, Production Surfaces and Economic Optima in Fertilizer Use.
- LUMAN E. CAIRNES, B.S. Washington State College 1950; Ph.D. Iowa State College 1956, Factors Affecting Fertilizer Use on Iowa Farms.
- JOHN CONRAD CALLAHAN, B.S. Michigan State College 1947; M.F. Duke University 1948; Ph.D. Purdue University 1955, Factors Affecting the Price of Hardwood Stumpage in Indiana.
- ALVARO CHAPARRO, B.S. National University, Colombia, South America 1949; M.S. The Pennsylvania State College 1951; Ph.D. The Pennsylvania State University 1955, Role Expectation and Adoption of New Farm Practices.
- FLOYD LOUIS CORTY, B.S. Pennsylvania State College 1940; M.S. Pennsylvania State College 1949; Ph.D. Cornell 1955, Evaluation of Rural Property Assessments in 15 New York Towns.
- ARTHUR JAMES COUTU, B.S. University of Connecticut 1949; M.S. University of Connecticut 1950; Ph.D. North Carolina State College 1955, An Economic Analysis of Soil Conservation Practices In A Selected Area of North Carolina.
- IRVING DUBOV, B.S. Rutgers University 1948; Ph.D. University of California 1955, The Evaporated Milk Industry in Western Region.
- ROGER STEWART EULER, B.S. Purdue 1943; M.S. Purdue 1948; Ph.D. Purdue 1955,

Evaluation and Improvement of Work Methods in Grain Handling by Indiana Farmers.

JESSE EDWIN FARIS, JR. B.S. State College of Washington 1948; M.A. State College of Washington 1951; Ph.D. North Carolina State College 1955, Adjustments In Milk Supply, Grade A Dairy Farms, North Carolina Piedmont.

WILLIAM STARBIRD FARRIS, B.S.A. University of Arkansas 1939; M.S. University of Arkansas 1946; Ph.D. Purdue University 1955, Trends in the Frozen Food Locker Industry and Utilization of Labor in Selected Indiana Locker Plants.

JOHN L. FISCHER, B.S. Oklahoma A & M College 1947; M.S. Oklahoma A & M College 1948; Ph.D. University of Wisconsin 1955, The Economics of Cooperative Purchasing of Farm Supplies in Tennessee, With Emphasis on the Financial Aspects.

WILLIAM ARTHUR FRANK, B.S. University of Pennsylvania 1943; M.A. University of Chicago 1949; Ph.D. University of Chicago 1955, Costs and Returns to Farmers from Reducing Seasonal Variability of Hog Supplies.

PRICE GITTINGER, B.S. University of California at Los Angeles; Ph.D. Iowa State College 1955, Economic Development Through Agrarian Reform.

LOYD GLOVER, JR., B.S. University of Nebraska 1948; M.A. University of Nebraska 1950; Ph.D. University of Wisconsin 1955, Public Purchase Of Land As A Means Of Land Use Adjustment.

LOUIS-MARIE GOREUX, Licence en Droit, 1949 Universite de Paris, France, Docteur en Sciences Agronomiques, 1952, Universite Catholique de Louvain, Belgium, Docteur en Droit, 1952, Universite de Paris, France, Ph.D. University of Chicago 1955, Agricultural Productivity and Economic Development in France (1852-1950).

THOMAS IVER GUNN, B.S. Brigham Young University 1951; M.S. Utah State Agricultural College 1953; Ph.D. Cornell 1955, Merchandising Fryers in Self-Service Supermarkets.

ISRAEL IRVING HOLLAND, B.S. University of California 1940; M.S. University of California 1941; Ph.D. University of California 1955, Some Factors Affecting the Consumption of Lumber in the United States with Emphasis on Demand.

WEI JEN HUANG, B.S. St. John's University 1948; M.S. Michigan State College 1950, Ph.D. University of Illinois 1955, Problems of Developing Agricultural Cooperation in Development of Underdeveloped Countries.

KAMOL ODD JANLEKHA, B.S. University of Philippines 1941; M.S. Cornell 1951; Ph.D. Cornell 1955, A Study of the Economy of a Rice-Growing Village in Central Thailand.

ARTHUR DAVID JEFFREY, B.S. Pennsylvania State College 1939; M.S. Pennsylvania State University 1953; Ph.D. Pennsylvania State University 1956, An Economic Analysis of Idle Farm Land in Potter County, 1953.

JOSEPH MYRON JOHNSON, B.S. University of Maine 1940; M.S. University of Maine 1941; Ph.D. Cornell University 1955, Marketing Southeastern Early Irish Potatoes.

FRED EDWARD JUSTUS, JR., B.S. University of Illinois 1951; M.S. University of Illinois 1952; Ph.D. University of Illinois 1955, Agricultural Prices and Costs Suitable for Use in Appraising Farm Land for Long-Term Commitments.

MOTOSUKE KAIHARA, B.S. Kyoto University 1941; M.S. University of Wisconsin 1953; Ph.D. University of Wisconsin 1955, Economic Development Of Japanese Agriculture—An Appraisal Of The Significance Of Land Tenure In Agricultural Development.

CLYDE R. KEATON, B.S. University of Tennessee 1950; M.S. University of Tennessee 1952; Ph.D. University of Minnesota 1955, Economics of Apple Production in Hando Valley, New Mexico. (An area characterized by several disadvantages but with one advantage—earliness of crop.)

ROSS ANTHONY KELLY, B.S. Utah State College 1940; M.S. Utah State College 1941; Ph.D. University of Illinois 1955, Vegetable Canning Industry in Illinois.

MOHAMED, A. W. KHALIL, B.S. Farouk I University 1947; M.S. University of Wisconsin 1953; Ph.D. University of Wisconsin 1955, The Relationship Of The Business Cycle To The Organization Of Cooperative Associations.

MALCOLM BRICE KIRTLEY, B.S. University of Missouri 1941; M.S. University of Missouri 1951; Ph.D. University of Illinois 1955, Some Economic Aspects of Meat Retailing and Pricing.

RALPH GALEN KLINE, B.S. Pennsylvania State College 1940; M.S. Pennsylvania State College 1952; Ph.D. North Carolina State College 1956, An Economic Analysis of Production Possibilities For Selected Harvested Forage Crops, Piedmont Areas, North Carolina.

MARVIN W. KOTTKE, B.S. University of Minnesota 1951; M.S. University of Minnesota 1952; Ph.D. University of Minnesota 1955, An Economic Analysis of Farm Lease Arrangements.

RAGNAR LAWERANCE KRISTJANSON, B.S. North Dakota State College 1951; M.A. University of Nebraska 1952; Ph.D. University of Wisconsin 1955, Dairy Marketing.

JOHN LUDWIG KUPKA, B.S. Cornell 1950; M.S. Purdue University 1953; Ph.D. Cornell 1956, A Study of Flower Merchandising in Self-Service Outlets.

ALMON T. MACE, Ph.D. The George Washington University 1956, Farmers Home Administration Type Credit As An Instrument Of Postwar Agricultural Policy.

HARCHARAN SINGH MANN, B.S. University of Punjab 1944; M.S. Kansas State College 1955; Ph.D. Kansas State College 1955.

JOE ALLEN MARTIN, B.S. Clemson College 1946; M.S. Clemson College 1948; Ph.D. University of Minnesota 1955, The Impact of Industrialization Upon Agriculture. A Study of Off-Farm Migration and Agricultural Development in Weatly County, Tennessee.

GLYNN McBRIDE, B.S. University of Wisconsin 1953; Ph.D. University of Wisconsin 1955, International Trade Policies And Programs With Special Reference To The Dairy Industry.

JOHN HENRY McCOV, B.S. Kansas 1940; M.S. Kansas State 1942; Ph.D. University of Wisconsin 1955, Grain Storage Policy With Particular Reference To Cost Of Storing Wheat In Kansas.

DEAN ELGAR MCKEE, B.S. North Dakota State College 1952; M.S. Iowa State College 1954; Ph.D. Iowa State College 1955, Economics of Corn-Soybean Oilmeal Substitution for Hogs on Pasture.

ARTHUR H. MILLER, B.S. University of Wisconsin 1947; M.S. University of Wisconsin 1949; Ph.D. University of Wisconsin 1955, Economic Aspects Of Bulk Milk Handling.

CLARENCE J. MILLER, B.S. Iowa State College 1940; M.S. University of Connecticut 1942; Ph.D. Harvard University 1955, The Economic Effects of Transportation Changes on Potato Marketing from Aroostock County, Maine.

ERNEST J. MOSBACK, B.S. River Falls State College 1952; M.S. Iowa State College 1955; Ph.D. Iowa State College 1954, Application of Several Econometric Techniques to a Theory of Demand with Variable Tastes.

CLESBY C. MOXLEY, B.S. Berea College, Kentucky 1939; M.S. University of Kentucky 1953, Ph.D. University of Kentucky 1955, A Conceptual Study Of The Farm And Home Development Program.

ALLAN GEORGE MUELLER, B.S. University of Illinois 1945; M.S. University of Illinois 1947; Ph.D. University of Illinois 1955, Application of Economic Theory to Farm Record Analysis.

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- DALE KEITH COLYER, B.S. University of Illinois 1954; M.S. University of Illinois 1955.
- MELVIN LEON COTNER, B.S. Kansas State College 1949; M.S. Kansas State College 1955, Effects of Variations in Inputs and Price Relationships on the Value of Cropland, Geary County, Kansas.
- THOMAS E. CRANFORD, B.A. Louisiana State University 1954; M.S. Louisiana State University 1955, The Farm Real Estate Market in Natchitoches Parish.
- T. P. CRIGLER, B.S. Arkansas State College 1952; M.S. Cornell 1955, The Merchandising of Potatoes Separated For Cooking Purposes by the Specific Gravity Process, 1954-1955 Season.
- BILLIE MACK CROSSWHITE, B.S. Berea College, Kentucky 1953; M.S. Michigan State University 1956.
- ROBERT DAVID DAHLE, B.S. Pennsylvania State University 1954; M.S. Pennsylvania State University 1956, A Preliminary Economic Evaluation of The Corey Creek Watershed.

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ALVIN N. DECK, B.S. Texas A & M 1951; M.S. Texas A & M 1955, The Effect of Egg Grading on Quality and Returns to the Producer in Selected Areas of South Central Texas.

BASILIO DE LOS REYES, B.S. University of Philippines 1953; M.S. Cornell 1955, Prices of Copra.

ANTONIO SANCHEZ DELOZADO, B.S. Cornell 1953; M.S. Cornell 1956, Economic Land Classification as Used in the Town of Danby, Tompkins County, New York, 1954.

DAVID BRYON DIVER, B.S. Cornell 1954; M.S. Cornell 1955, Merchandising Fresh Peaches.

JOHN PHILIP DOLL, B.S. Montana State College 1953; M.S. Montana State College 1955, Economic Applications of Soil Survey Data in Irrigated Areas.

STANLEY W. DREYER, B.S. University of Colorado 1954; M.S. University of Minnesota 1955.

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CHAPMAN E. DUNHAM, B.S. Louisiana State University 1954; M.S. Louisiana State University 1955, The Economic Aspects of the Milk Audit Law.

CLARENCE DURWARD EDMOND, B.S. Oklahoma A & M College 1946; M.S. Oklahoma A & M College 1955, The Effects of Oil and Gas Development on Agricultural Uses of Land in the West Edmond Oil Field.

WILLIAM CLARK EDWARDS, M.S. University of Missouri 1952, M.S. Purdue 1956, Estimation of Farm Resource Productivity from Central Indiana Accounting Records.

ALVIN CHARLES EGBERT, B.S. University of Kentucky 1954; M.S. University of Kentucky 1955, A Study of Resource Use on Crop-Share and Livestock-Share Rented Farms in Central Kentucky.

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ROGER PAUL ESSMAN, B.S. University of Nebraska 1954; M.A. University of Nebraska 1956, Some Aspects of Market Premiums for Hard Red Winter Wheat.

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- RONALD EUGENE FOWLER**, B.S. University of Illinois 1952; M.S. University of Illinois 1955, Credit Experience Among Men Reared on Farms in Washington and Jefferson Counties, Illinois, With Special Emphasis on Those Now Farming.
- GEORGE ROBINSON FUTHEY**, B.S. Ohio State University 1954; M.S. Ohio State University 1955, Economic and Social Aspects of Part-Time Farming in Northeastern Ohio.
- FRED HUBERT GARNER**, B.S. Clemson College 1954; M.S. Clemson College 1955, Alternative Methods for Crosswise Packing of Congo Watermelons.
- EARLE EDWARD GAVETT**, B.S. University of Maine 1952; M.S. University of Maine, 1955, A Study of Developing Master Containers For Transporting Prepackaged Maine McIntosh Apples.
- ALLAN HOWARD GIFFORD**, B.S. Ohio State University 1954; M.S. Ohio State University 1955, Operating Cost and Gross Profit Factors in Retail Meats.
- CLARENCE FORREST GILFEATHER**, B.S. Montana State College 1948; M.S. Montana State College 1955, Resource Development of Minor Drainage Basins.
- JERRY GOODALL**, B.S. Oklahoma A & M College 1951; M.S. Pennsylvania State University 1956, Commercial Beef and Calf Operations in Southwestern Pennsylvania.
- WESLEY H. GRAY**, B.S. University of Minnesota 1947; M.S. University of Minnesota 1955.
- MOHAMAD AREF GHAUSSI**, B.A. University of Kabul 1952; M.S. University of Illinois 1955, How to Meet Problems in the Development of Agriculture in Afghanistan.
- LESLIE ALBERT GLASCOCK**, B.S. Tennessee Polytechnic Institute 1952; M.S. University of Tennessee 1955, Market Structure of Buying Firms and Practices of Strawberry Growers in the New Cumberland Mountain Area of Tennessee, 1954.
- JACK B. GOODWIN**, B.S. Brigham Young University 1953; M.S. Utah State Agricultural College 1955, An Economic Analysis of Alfalfa Seed Production Costs and Returns in Utah, 1952.
- ANDRES P. GOSECO, JR.**, B.S. University of Philippines 1951; M.S. Cornell 1955, Some Economic Aspects of the Abaca (Manila Hemp) Industry.
- FRANK MICHAEL GRASBERGER**, B.S. Cornell 1951; M.S. Cornell 1955, Experiments in Merchandising Sweet Corn at Retail 1952-1954 Seasons.
- FAWZI HABIB**, B.A. Egyptian University—Cairo 1944; M.S. North Carolina State College 1955, Some Factors Affecting Foreign Demand for Egyptian Cotton.
- LEIGH HUGH HAMMOND**, B.S. Clemson Agricultural College 1950; M.S. University of Tennessee 1955, Income Possibilities On Farms in The Cotton Section Of West Tennessee.
- PAUL EDGAR HAND**, B.S. University of Maine 1952; M.S. University of Maine, 1955, Competitive Position of Maine Potatoes in Each of Six Important Markets and Factors Affecting Potato Prices at Presque Isle, Maine.
- HARRY HAYS HARP**, B.S. University of Maryland 1954; M.S. University of Maryland 1956, Efficiency of Livestock Auctions in Maryland.
- BURTON J. HARRINGTON**, B.S. University of Georgia 1948; M.S. University of Georgia 1955, Revision of Georgia Farm Commodity Price Indexes.

ROLAND GORDON HARRIS, Rutgers University 1951; M.S. Pennsylvania State University 1955, Effect of Some Alternative Packing Practices of Costs and Returns to Apple Growers, Pennsylvania, 1954.

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VERNER GENE HURT, M.S. Mississippi State College 1955, Cost And Efficiency Of Selected Mississippi Fluid Milk Plants.

CARLTON ADOLPH INFANGER, B.S. 1955; M.S. Montana State College 1956, Economics of 2-4-D In Canada Thistle Control.

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DONALD FRANCIS JONES, B.S. Montana State College 1951, M.S. Montana State College 1956, Marketing Alternatives For Surplus Grade A Milk.

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- JOHN RUSSELL KING**, B.S. Oklahoma A & M College 1953; M.S. Oklahoma A & M College 1955, Some Of The Causes Of Difference In Income Among Farms Producing Milk For Manufacture In Northwestern Oklahoma, 1950.
- ALFRED ROBERT KOCH**, B.S. Rutgers 1953; M.S. Purdue University 1955, An Economic Analysis Of The Financial And Patronage Refund Policies of Selected Indiana Cooperatives.
- GANGADHAR S. KORI**, B.S. Bombay University, India, M.S. University of Minnesota 1955.
- KERMIT HARLAN KLEENE**, B.S. University of Minnesota 1942; M.S. University of Minnesota 1955.
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- CARL BAILEY LEWIS**, B.S. University of Nebraska 1952; M.A. University of Nebraska 1955, Role of Credit Unions in Agriculture.
- OTHMAR ALFRED LIMBERGER**, Dipl. Ing. 1953; M.S. Michigan State University 1955; An Analysis of The Relationships Between The Assessed Valuation and Sales Values of Real Property In Ingham County, Mich.
- INGVAR AXEL LINDSTROM**, The Royal Agricultural College—Ultana, Uppsala Sweden 1952; M.S. North Carolina State College 1955, A Study Of The Demand For Cucumbers And Peppers With Particular References To Southeastern North Carolina.
- MERWYN KEITH LINDSTROM**, B.S. University of Illinois 1950; M.S. University of Illinois 1956, Seasonal Income and Expenses of Illinois.
- HERACLIO A. LOMBARDO**, B.A. University of Arkansas 1949; M.S. University of Arkansas 1955.
- FARNE MADASKI**, B.S. Michigan State University 1941; M.S. Michigan State College 1955, An Analysis Of Alternative Enterprises For A Typical Cash Crop Farm In The Saginaw Thumb Area of Michigan.
- WILLIAM T. MANLEY**, B.S. M.S. University of Kentucky 1955, Field Seed Marketing In Kentucky With Special Reference To Orchard Grass.
- BRUCE WILBUR MARION**, B.S. Cornell 1954; M.S. Cornell 1955, Marketing Livestock From New York Farms, 1953.
- DONALD RAYMOND MARION**, B.S. Cornell 1954; M.S. Cornell 1955, Livestock Dealer And Commission Auction Operation In New York State, 1953.
- CHARLES FREDERICK MARSH**, B.S. Kansas State College, 1949; M.S. Kansas State College, Manhattan 1955, A Static Analysis of the Elasticity of Demand For Beef.
- ROBERT GORDON MATCHETT**, B.S.A. University of British Columbia 1951; M.S.A. University of British Columbia 1955, A Farm Management Guide for B.C.
- CHARLES ELMER McALLISTER**, B.S. The University of Vermont, 1954; M.S. The University of Vermont 1955, Utilization Of Milk By Local Vermont Dealers.
- ROBERT S. McGLOTHLIN**, Oregon State College 1953, M.S. Oregon State College 1955, Factors Affecting Oregon Farm Prices.
- HENSLEE CLIFFORD McLELLAN, JR.**, B.S. Clemson College 1954; M.S. Clemson

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LESLIE DONALD McMULLIN, B.S. University of Tulsa 1949; M.S. Oklahoma A & M 1955, A Study of Consumer Preferences For Dairy Products And Services In Oklahoma City, Oklahoma.

BERT DEAN MINER, B.S. Utah State Agricultural College 1953; M.S. Michigan State University 1955, Some Economics Aspects of Poultry Marketing In Detroit, Michigan With Emphasis On The Feasibility of Centralized Prepackaging Of Poultry Meat.

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JOHN EMERY MOORE, B.S. Ohio State University 1940; M.S. Ohio State University 1955, The Contribution Different Tenure Groups Make To Land Improvement And To Selected Community Activities In Madison County, Ohio.

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ROBERT H. MOORE, B.S. Cornell University 1953; M.S. Michigan State University 1955, An Analysis of Intermarket Price Relationships For Potatoes In The United States, 1951-1953.

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JOHN NAIRN, B.S.A. University of British Columbia 1951; M.S. Oregon State College 1955, Economic Comparisons of Alternative Land-Use Systems On Selected Farms in the Oregon Wheat-Summerfallow Area.

PAUL EMMETT NESSELROAD, B.S. West Virginia University 1947; M.S. West Virginia University 1955, The Kinds, Costs and Quantities of Lime Materials Used by West Virginia Farmers.

TERRY N. NORMAN, B.S. State College of Washington 1952; M.S. Montana State College 1956, Marginal Rates of Product Substitutes On Units Susceptible To Shifts Between Range Forage And Dryland Crop Production.

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JOHN ROBERTS PARKS, B.S. Pennsylvania State College 1951; M.S. Kansas State College, Manhattan 1955, Some of the Problems of Economic Development of Underdeveloped Countries; Turkey, a Case Study.

- GEORGE A. PAVELIS, B.S. Montana State College 1950; M.S. Montana State College 1955, Agricultural Implications of Weather Control.
- KENNETH ALVIN PFAFF, B.S. Kansas State College, 1954; M.S. Kansas State College, Manhattan 1955, Accuracy of Wheat And Corn Price Forecasts at Kansas State College.
- TRAVIS DENTON PHILLIPS, M.S. Mississippi State College 1955, Adequacy Of Public Warehousing and Storage Facilities and Services For Mississippi Grain Crops.
- JERRY HILL PADGETT, B.S. Clemson College 1954; M.S. Clemson College 1955, Analysis of Milk Vending Operations In South Carolina.
- II NAM PARK, M.S. Cornell 1955, A Brief Study of Agricultural Credit in South Korea.
- TUKARAM Y. PATIL, B.S. College of Agriculture, Poona, India 1952; M.S. Michigan State University 1955, A Study of Recent Changes in Cotton Production Pattern and Techniques in the U.S. and Their Applicability to Indian Conditions.
- DAVID HARRY PENNY, B. of Econ. University of Adelaide, Adelaide Australia 1952; M.S. Stanford University (Food Research Institute) 1955.
- JEROLD F. PITTMAN, B.S. Clemson Agricultural College 1951; M.S. Clemson Agricultural College 1956, Production Practices and Costs in Growing Fall Tomatoes, Spartanburg County, S.C. 1953.
- CHARLES RAY PUGH, B.S. North Carolina State College 1951; M.S. North Carolina State College 1955, Factors Influencing Level of Income and Income Distribution in the Northern Piedmont Counties of North Carolina.
- WALTER LEVI QUINCY, B.S. Colorado A & M 1952; M.S. Oregon State College 1955, An Evaluation of Methods of Estimating 1953 Costs of Producing Strawberries.
- THOMAS S. RACKHAM, B.S. University of Saskatchewan 1937; M.S. Montana State College 1956, Extension Implications of Budgets in Decision Making.
- JOHN GORDON RIEHL, B.S. Ohio State University 1952; M.S. Ohio State University 1955, Methodology and Statistical Analysis Employed in the Akron Market Milk Distribution Study.
- CHARLIE B. ROBBINS, M.S. Mississippi State College 1956, Financial Management Analysis of Farmer Cooperatives in Mississippi.
- RONALD WALDO ROBINS, B.S. Utah State Agricultural College 1951; M.S. Utah State Agricultural College 1956, Analysis of Costs in Chemical Control Of Weeds And Insects in Central Utah, 1954.
- JOSHUA F. ROBINSON, B.S. Wisconsin State College 1952; M.S. South Dakota State College 1956, A Farm Building Evaluation Technique For Tax Assessment.
- WILLIAM EGBERT ROBINSON, B.S. University of Vermont 1952; M.S. Purdue 1955, An Analysis of the Effects of the Operation of Country Elevators Upon Prices Paid for Wheat and Corn in Indiana.
- RAFAEL RODRIGUEZ-CANTERO, B.S.A. University of Puerto Rico 1951; M.S. Cornell 1955, A Suggested Educational Program in Agricultural Credit For The Puerto Rican Farmer.
- CARL ROSE, B.S. University of Arkansas 1940; M.S. University of Arkansas 1956.
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RICHARD LEE SIMMONS, B.S. Kansas State College 1951; M.S. Kansas State College Manhattan 1955, An Appraisal of the Probable Success of the National Wool Marketing Act of 1954.

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JAMES LARKIN STALLINGS, B.S. Purdue 1952; M.S. Purdue 1956, Inputs and Returns In The Production of Various Crops in Southwestern Indiana.

JAMES ROBERT STRAIN, B.S. Purdue 1950; M.S. Purdue 1955, Adapting Indiana Dairy Marketing Structures To Farm Bulk Handling of Milk.

SAMUEL L. STOKES, B.S. Oklahoma A & M 1954; M.S. Oklahoma A & M 1955, Impacts of Physical And Biological Factors Affecting The Economic Development of Irrigation Resources.

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HENRY ARTHUR THOMAS, B.S. University of Wales; M.A. North Carolina State College 1955, An Appraisal of the Effect of Sociological and Economic Development Upon Agricultural Education in the United States.

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ERNESTO FRANKEL WENDE, A.B. Berea College, Berea, Kentucky 1951; M.A. University of Nebraska 1956, Settlement in the Santa Cruz Area; A Proposed Program for the Development of an Area With European Immigrants and Bolivian Indians.

JERRY GLENN WEST, B.S. Oklahoma A & M 1952; M.S. Oklahoma A & M 1955, A Pilot Study of Farmer's Preference for Marketing Services in Kingfisher County, Oklahoma.

WALTER LEWIS WHEELER, B.S. University of Illinois 1943; M.S. University of Illinois 1955, The Economic Possibilities For The Utilization Of Corncobs.

HARRY FORDYCE WHITNEY, B.S. University of Maine 1954; M.S. Cornell 1955, A Dairy Farm Management Study For Oneida County, New York.

CHARLES ARCHIBALD WILMOT, B.S. Vermont 1949; M.S. Purdue 1956, Adequacy and Accuracy of Livestock Market News In Indiana.

JOHN HUGH WINN, B.S. Texas A & M 1952; M.S. Texas A & M 1955, An Economic Analysis of Factors Affecting Sheep and Lamb Marketing in Texas.

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- CALVIN C. BOYKIN, B.S. Texas A & M College 1952; M.S. Texas A & M College 1956, Obstacles to the Application of Soil and Water Conservation Practices on Tenant-Operated Farms in the Blacklands of Texas.
- JOHN RONALD BRAKE, B.S. Michigan State University 1955; M.S. Michigan State University 1956, Monthly Variations in Income and Selected Expense Items on Dairy Farms and Their Significance.
- GENE AUSTIN BRAMLETT, B.S. Murray State College, Kentucky 1953; M.S. University of Kentucky 1957.
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- DEAN A. BROWN, B.S. Iowa State College; M.S. Iowa State College 1956, Effects of Farm Consolidation on Coast and Output.
- JOSEPH PATRICK BROWN, B.S. South Dakota State College 1954; M.S. South Dakota State College 1956, Egg Marketing.
- ROBERT L. BUNDICK, B.S. Louisiana State University 1955; M.S. Louisiana State University 1957.
- JACK MERRIL BURKE, B.S. North Dakota Agricultural College 1953; M.S. North Dakota Agricultural College 1957, An Analysis of Market News Media.
- WALTER RAY BUTCHER, B.S. University of Idaho 1955; M.S. Iowa State College 1956.
- JOSE MARIA ESCAY CACHO, B.S. Ateneode (Manila) 1954; M.S. Louisiana State University 1956.
- JARVIS LYNN CAIN, B.S. Purdue University 1955; M.S. Ohio State University.
- ROBERT CAMPBELL, B.S.A. University of British Columbia 1948; M.S.A. University of British Columbia 1957, A Production Function for Poultry Farms in the Lower Fraser Valley.
- DALE H. CARLEY, B.S. Ohio State University 1955; M.S. Ohio State University 1956, Bulk Milk Tank Development in Ohio.
- EDWARD ELMER CARSON, B.S. Purdue University; M.S. Purdue University 1956, Merchant Credit in Central Indiana.
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CHARLES RALPH SMITH, M.S. Mississippi State College 1956, Dairy Products Consumption As Related To Income, Race, And Family Make-up In Urban Areas.

CLARENCE B. SMITH, JR., B.S. Michigan State University 1951; M.S. Michigan State University 1957.

DICK WAYLAND SMITH, B.S. University of Tennessee 1949; M.S. University of Tennessee, Tentative Economies Of Feed Production On Dairy Farms In East Tennessee.

EJVIND SONDERGAARD, B.A. Royal Veterinary And Agricultural College, Copenhagen 1951; M.S. University of Maryland 1957.

TEDD ST. JOHN SPECK, B.S. Purdue 1951; M.S.A. Purdue 1956.

LINCOLN SPENCER, B.S. Southeastern Louisiana College 1950; M.S. Louisiana State University 1956, Adequacy Of Various Sample Sizes For Family Type Sugar Cane Farms In Louisiana.

MILLARD JOHN STANEK, B.S. University of Nebraska 1941; M.A. University Of Nebraska 1956, Factors Influencing Decisions Made By Farmers Of Compliance Or Non-Compliance.

CLYDE JOHN ST. CLERGY, B.S. Southwestern Louisiana Institute 1956; M.S. Louisiana State University 1957.

JAMES H. STEVENSON, B.S. University of Illinois 1955; M.S. Purdue 1957, Retail Meat Pricing.

WINSTON GRAHAM STUART, Diploma of Imperial College T.A. Imperial College of Tropical Agriculture, Trinidad 1938; M.S. Cornell 1956, A Co-operative Approach To Land Settlement In Jamaica.

JOHN ABRAHAM STUDEBAKER, B.S. Ohio State University 1953; M.S. Ohio State University 1956, An Analysis Of Labor And Capital Requirements To Make And Store Grass Silage In Different Type Silos.

GENE D. SULLIVAN, B.S. Arkansas State College 1955; M.S. Louisiana State University 1957, Cost And Returns Of Irrigating Cotton.

CHARLES WILLIAM SWANK, B.S. Ohio State University 1953; M.S. Ohio State University 1956, Merchandizing Hothouse Tomatoes.

CHARLES SWEARINGEN, B.S. University of Kentucky 1943; M.S. University of Kentucky 1956, Minimum Size Efficient Farms In South Central Kentucky (Pulaski, Casey and Adair Counties).

THOMAS BRANNEN SWINSON, B.S.A. University of Georgia 1955; M.S.A. University of Georgia 1957, Economic Analysis Of Bulk Tank Handling Of Milk In Georgia.

TAKASHI TAKAYAMA, M.S. Iowa State College 1956.

HIROSHI TAKEDA, B.S. Utsunomiya University, Japan 1954; M.S. Iowa State College 1956, A Study In Some Aspects Of Farmers' Saving.

SHIRO TAKEI, B.S. University of Hawaii 1938; M.S. Michigan State University 1956, The Possible Contributions of Marketing Education and Information To The Solution of Fruit and Vegetable Marketing Problems In Hawaii.

EARL GILBERT TAYLOR, B.S. University of Maryland 1953; M.S. University of Maryland 1956, Economic Study of Washington D.C. Flower Market.

RICHARD BILLING THOMAN, B.A. Yale 1953; M.S. Ohio State University 1957.

KENNETH HOWARD THOMAS, B.S. Cornell 1950; M.S. Cornell 1956, St. Lawrence County Land Classification Summary.

WENDELL HUGH THOMAS, B.S. Clemson College 1949; M.S. Clemson College 1955, The Merchandizing Of Fresh Frying Chickens In Retail Stores In Non-Metropolitan Areas of South Carolina.

ALTON W. TIEKEN, B.S. A & M College of Texas 1953; M.S. Texas A & M 1956, The Texas Goat Situation.

FABIAN ARAMIL TIONGSON, B.S. University of the East Manila, Philippines 1951; M.S. Purdue 1956, A Comparative Financial And Business Analysis Of Indiana REMC Operations.

JAMES M. TORRANCE, M.S. University of Florida 1956, Estimate Acreage And Yield of Florida Green Beans.

MAMERTO BRAVO TOTAAN, B.S. Araneta Institute Of Agriculture (Philippines) 1954; M.S. Montana State College 1957, A Study of Extension Methods And Techniques.

ANTONIOS EPAMINONDAS TRIMIS, B.S. Cornell University 1954; M.S. University of Tennessee 1956, Why 107 Farmers Do And Do Not Patronize Farmers' Purchasing Cooperatives.

WANG YOUNG TSAO, B.S. National Tarwan University, China 1952; M.S. Iowa State College 1957.

TIAN TORING TSUI, B.A. National Chengchi University, Nanking, China 1949; M.S. University of Illinois.

CARLOS FRANKLIN TUCKER, B.Sc. Ohio State University 1954; M.S. Ohio State University.

KYI TUN, B.A. University of Rangoon, Burma 1952; M.S. Iowa State College 1956, (a) The Growth of Rice Industry In Burma or (b) Ag Problems and Programs In Burma.

SHIAN YUNG TUNG, B.S. University of Taiwan 1953; M.S. University of Illinois 1956.

WILLIE GLENN TUSSEY, B.S. North Carolina College 1949; M.S. North Carolina State College 1957.

AKIRA UCHIDA, B.S. Pennsylvania State University 1955; M.S. Pennsylvania State University.

ERWIN OTTO ULLRICH, JR., B.S. Wisconsin State College 1952; M.S. Colorado A & M College 1957, Sheep And Lamb Marketing In Northeast Colorado.

NORMAN LELAND ULSAKER, B.S. North Dakota Agricultural College 1953; M.S. North Dakota Agricultural College 1957, Hog Marketing (Tentative).

JUAN JOSE VALLDEJULI, B.S. Clemson A & M College 1943; M.S. Cornell 1956, The Marketing of Puerto Rican Fruits and Vegetables.

STEFANUS PETRUS VANWYK, B.S. University Pretoria, South Africa 1949; M.S. University of Pretoria, South Africa 1953. 2nd M.S. University of Illinois.

COSTAS KLEANTHI VARKARIS, B.Sc. North Carolina State College 1954; M.S.A. Ontario Agricultural College 1956, An Appraisal Of Fertilizer Use In The Production Of Potatoes In Ontario.

JEROME BEN VERNAZZA, B.A. Stanford University (Economics) 1955; M.A. Stanford University (Food Research Institute) 1956.

PRAMOON VIDHYANANDA, B.A. Chulalongkorn University, Thailand 1940; M.S. Louisiana State University 1956, Foreign Student Taking 36 Hours of Course Work.

LESTER VISLISEL, B.S. Iowa State College; M.S. Iowa State College 1957.

JAMES WARREN VITTETOE, B.S. Louisiana Polytechnic Institute 1955; M.S. Louisiana State University 1957.

RAYMOND DANIEL VLASIN, B.S. University of Nebraska 1953; M.A. University of Nebraska 1956, Comparison of Alternative Systems Of Farming In Southern Kimball County.

DONALD LEROY VOELSANG, B.S. Iowa State College 1951; M.S. Purdue 1956, Marketing and Financing Poultry.

ALVI OSMOND VOIGHT, B.S. Pennsylvania State University 1955; M.S. Pennsylvania State University.

JOSEPH VON AH, Diploma in Agrarian Engineering, 1954, Swiss Federal Institute of Technology, Zurich, Switzerland; M.A. University of Nebraska 1956, Credit Funds For Agriculture In The United States and Switzerland.

DUANE GEORGE VONLANKEN, B.S. University of Illinois 1953; M.S. University of Illinois.

DONALD LEE WALKER, B.S. University of Idaho 1955; M.S. University of Idaho 1957.

LUTHER T. WALLACE, JR., B.A. Harvard 1949; M.S. Oregon State College 1956, A Comparative Study of Beef Production Systems On Eastern Oregon Ranches.

Hsin-Fu Wang, B.S. National Central University, Nanking, China 1947; M.S. Michigan State University 1957.

OMER MILO WANGEN, B.S. Colorado A & M 1955; M.S. Colorado A & M College 1956, Economics of Range Reseeding.

CLINE JEFFERSON WARREN, B.S. The Agricultural And Technical College of North Carolina 1952; M.S. Purdue 1956, Evaluation Of Seasonal Patterns In Prices.

HARVEY K. WARRICK, B.S. in Agri. Ohio State University 1952; M.S. Oregon State College.

CLYDE RAYMOND WEATHERS, B.S. North Carolina State College 1951; M.S. North Carolina State College 1956-57.

JOHN E. WEIL, B.S. University of Connecticut 1954; M.S. University of Connecticut 1956, Labor Requirements For Dairy Chores.

PINS WEISGERBER, B.Sc. University of Alberta 1950; M.S. Oregon State College 1956.

GUNTHER GEORGE WEISSENSEE, B.S. Rutgers University 1950; M.S. Rutgers University 1957, Marketing Poultry Products In New Jersey.

WILLIAM HENRY WEST, B.S. University of Delaware 1954; M.S. University of Delaware 1957, Economics of Forage Production And Utilization On Delaware Dairy Farms.

- JULIAN HUBERT WETZEL, B.S. University of Illinois 1948; M.S. University of Illinois.
- DUDLEY GORDON WILLIAMS, M.S. Mississippi State College 1957, Some Topic related to livestock marketing.
- ROGER WILLSIE, B.S. University of Missouri 1955; M.S. Iowa State, 1956 Compensation For Improvements.
- LOWELL WILSON, B.S. Murray State College, Kentucky 1953; M.S. University of Kentucky 1956, The Reappraisal Of Cream Marketing In Kentucky.
- THOMAS ALLEN WILSON, Dairy Technology Ohio State University 1955; Agricultural Economics Ohio State University 1957.
- DONALD L. WINKELMANN, B.S. University of Nebraska 1953; M.A. University of Nebraska 1956, Some Factors Affecting The Supply of Wheat In Nebraska.
- MYRON EUGENE WIRTH, B.S. Michigan State University 1951; M.S. Michigan State University 1956, Production Response In Four Michigan Farming Areas To Agricultural Controls In 1954.
- FREDERIC CRAWFORD WISE, B.S. Ohio State University 1949; M.S. Ohio State University 1956, Factor Effecting Tenant Participation In Community Activities.
- DONALD GEORGE WOLF, B.S. Rutgers University 1955; M.S. Rutgers University 1957, Marketing Floricultural Products In New Jersey.
- CLYDE EUGENE WOODALL, B.S. Clemson College 1955; M.S. Clemson College 1956, An Economic Study Of Small Farms In Pickens County, South Carolina.
- WILLIAM WOODROW, B.S. University of Kentucky; M.S. University of Kentucky 1956, Prepacking Tomatoes In Northern Kentucky.
- WILLARD FRANKLIN WOOLF, B.S.A. Arkansas State College 1955; M.S. Louisiana State University 1957.
- JEAN B. WYCKOFF, B.S. Ohio State College 1953; M.S. Ohio State College 1957.
- IVAN FREDERICK WYMORE, B.S. Colorado A & M 1955; M.S. Colorado A & M 1957, (In Area Of Farm And Home Development).
- SHOKO YAMASATO, B.S. Michigan State University 1955; M.S. Michigan State University 1957.
- LAWRENCE YOUNG, B.S.A. University of British Columbia 1942; M.S.A. University of British Columbia 1958.
- JOHN M. ZIMMER, B.S. North Dakota State College 1955; M.S. North Dakota State College 1956, Grain Transportation And Storage (tentative).

The Canadian Agricultural Economics Society invites members of the American Farm Economic Association to attend its annual meeting at the University of Toronto, June 26 to 28, 1956.

### PROGRAMME

#### CANADIAN AGRICULTURAL ECONOMICS SOCIETY MEETING, 1956 University of Toronto Campus, Room 252, Mechanical Building June 26-28

JUNE 26, 1956, 2-5 P.M. *Chairman: H. L. PATTERSON*  
Theme: Agricultural Policy

2:00 P.M. WHAT CRITERIA CAN BE USED IN FORMULATING AND EVALUATING AGRICULTURAL POLICY?

J. P. Cairns, Ontario Agricultural College, Guelph.

3:00 P.M. PURPOSES AND ASSUMPTIONS UNDERLYING RESEARCH AND EXTENSION IN AGRICULTURAL PRODUCTION.

B. H. Kristjanson, Canada Department of Agriculture, Ottawa.

Discussion: D. W. Carr, Department of Fisheries, Ottawa.

4:00 P.M. PURPOSES AND ASSUMPTIONS UNDERLYING CANADIAN FARM PRICE SUPPORTS.

W. M. Drummond, Royal Commission on Canada's Economic Prospects, Ottawa.

Discussion: A. H. Turner, Canada Department of Agriculture, Ottawa.

4:30 P.M. CONCERNING CANADIAN AGRICULTURAL POLICY.

D. Mc. Wright, McGill University, Montreal.

WEDNESDAY, JUNE 27, 9-12 A.M. *Chairman: D. R. CAMPBELL*  
Theme: Milk Marketing

9:00 A.M. TRENDS IN MARKETING WHOLE MILK.

W. J. Anderson, University of British Columbia, Vancouver.

10:00 A.M. THE EFFECT OF MILK PRICE DIFFERENTIALS ON THE INCOME OF DAIRY FARMERS.

D. K. Fairbarns, Macdonald College, P.Q.

Discussion: H. L. Patterson, Ontario Department of Agriculture, Toronto.

11:00 A.M. A LINEAR PROGRAMMING STUDY IN DAIRY PLANT OPERATION.

J. C. Snyder, Purdue University, Lafayette, Indiana.

Discussion: B. A. Macdonald, Canada Department of Agriculture, Ottawa.

THURSDAY, JUNE 28, 9-12 A.M. *Chairman: M. E. ANDAL*  
Theme: Farm Management

9:00 A.M. GENERAL FARM ACCOUNTS—WHAT PURPOSE CAN THEY SERVE?

G. C. Retson, Canada Department of Agriculture, Truro, Nova Scotia.

Discussion: P. J. Thair, University of Saskatchewan, Saskatoon.

10:00 A.M. FARM MANAGEMENT RESEARCH DATA NEEDED FOR EXTENSION.

J. H. Clark, Ontario Department of Agriculture, Toronto.

Discussion: T. O. Riecken, Canada Department of Agriculture, Winnipeg.

11:00 A.M. THE PLANNING AND CO-ORDINATION OF A SPECIFIC JOINT RESEARCH PROJECT.

P. A. Wright, Ontario Agricultural College, Guelph.

Discussion: Wm. Darcovich, Canada Department of Agriculture, Edmonton.

CONDUCTED TOUR OF CALIFORNIA AGRICULTURE  
AUGUST 24 TO 26, 1956

A THREE-DAY conducted bus tour of California agriculture has been planned by a special committee of the American Farm Economic Association and the Western Farm Economics Association for participants in their joint annual meeting in August.

The tour will begin on the University of California Berkeley campus on Friday morning, August 24, at 7:30. Members of the tour will cross the Coast Range to the lower San Joaquin Valley to visit farms and agencies, spend the second day in that area, recross the Coast Range and, on the third day, visit the Coastal valleys. Cities defining the tour limits include Berkeley, Stockton, Merced, Salinas, and Asilomar. The tour will end at the Asilomar Conference Grounds around 3:00 P.M. on Sunday, March 26.

Tour members will see the Central Valley Project, including the Tracy Pumping Plant, the Delta-Mendota Canal, and irrigated farms in the area. Visits will be made to cattle ranches (beef calves, fat cattle, and milk), and farms producing general crops (cotton, feed crops, sugar beets, and grains), fruits (tree fruits, grapes, and strawberries), and vegetables (artichokes and lettuce). Marketing firms for walnuts, fruits, and vegetables also will be on the itinerary.

There will be opportunities to discuss organization, operations, and management with the operators of the individual farms and marketing firms visited. The farms selected will exhibit a wide range in production, organization, resource use, scale, intensity, technology, specialization, and management. The marketing agencies will illustrate organization, technology, scale, and adjustment to demand and market structure. An agricultural economist familiar with the region and the farm enterprises to be visited will accompany each bus to answer questions and point out features of interest. Data on the operations of each enterprise visited will be made available to all participants in advance.

AFEA members who are interested in joining the conducted tour are *urged to register for it as soon as possible*. The tour fee, which includes transportation and lodging for Friday and Saturday nights (August 24 and 25), is \$20.00 per person; meals are extra.

Please address applications for registration, and inquiries concerning the tour, to:

MISS ELIZABETH COCKRILL, *Secretary-Treasurer*  
Western Farm Economics Association  
212 Post Office Building  
Berkeley, California

## AGRICULTURE IN ECONOMIC GROWTH AND STABILITY

### JOINT ANNUAL MEETING AMERICAN FARM ECONOMIC ASSOCIATION AND WESTERN FARM ECONOMICS ASSOCIATION

ASILOMAR CONFERENCE GROUNDS, PACIFIC GROVE, CALIFORNIA

AUGUST 26-29, 1956

#### *Preliminary Program*

(This draft represents the status of March 30 and contains only the names of those who had agreed to participate by that date. Chairmen, moderators, and rapporteurs have not been indicated.)

#### SUNDAY, AUGUST 26

(The conducted tour of California agriculture, which begins on Friday, August 24, at 7:30 A.M. in Berkeley, will end at 3:00 P.M. on Sunday, August 26, at Asilomar.)

3:00 to 6:00 P.M. Registration

4:00 to 6:00 P.M. AFEA Executive Committee Meeting

8:00 to 11:00 P.M. Informal Reception, Music, Refreshments—Everyone welcome

#### MONDAY, AUGUST 27

9:00 to 9:45 A.M. Registration

9:45 to 10:00 A.M. *Opening Session*

H. R. Wellman, University of California, *Address of Welcome*

10:00 A.M. to 12:00 M. *General Session*

THE ECONOMICS OF GROWTH AND STABILITY IN THE UNITED STATES

"Growth and Stability in the General Economy"

T. W. Schultz, University of Chicago, "Agriculture in the United States Economy"

Discussants: E. J. Working, State College of Washington

J. H. Davis, Harvard University

12:00 M. to 2:00 P.M. *Luncheon Session*

E. D. Coke, Bank of America, "California's Agriculture, Its Unique Features and Problems"

2:00 to 4:45 P.M. *Section Meetings*

SECTION I. GROWING DEMAND FOR WATER—PRODUCT AND COST ALLOCATION

J. F. Timmons, Iowa State College, "Theoretical Considerations of Water Allocation Among Competing Uses and Users"

W. K. McPherson, University of Florida, "Can Water Resources Be Allocated by Competitive Pricing?"

R. E. Huffman, Montana State College, "Economic Implications of the Partnership Approach to Water Resources Development"

**SECTION II. THE ROLE OF FARM MANAGEMENT RESEARCH IN THE UNITED STATES, 1956-66**

- E. W. Kehrberg, Purdue University, "Farm Management Research Programs in the Decade Ahead"  
S. D. Staniforth, University of Wisconsin, "Institutional Considerations in Farm Management in the Decade Ahead"  
S. V. Ciriacy-Wantrup, University of California, "Policy Considerations in Farm Management Research in the Decade Ahead"  
Discussants: E. N. Castle, Oregon State College; G. P. Wood, University of Nevada; Andrew Vanvig, University of Arizona

**SECTION III. WHAT'S BEHIND WIDENING MARKETING PRICE SPREAD?**

- "Economic Implications of Current Transportation Policy Recommendations"  
"Salient Features of Rising Marketing Costs"  
"Alternate Approaches to Calculating Price Margins"

**SECTION IV. THE POOR IN AGRICULTURE**

- J. A. Martin, University of Tennessee, "Some Myths of Southern Economic Growth"  
Joseph Willett, U. S. Government, "A Comparative Analysis of the Earnings of White and Negro Farmers in the United States"  
W. E. Hendrix, Agricultural Research Service, "What to Do About Low Income in Agriculture"

**SECTION V. RESEARCH METHODS IN PRICE ANALYSIS**

- A. H. Harrington and Conrad Gislason, State College of Washington, "Demand and Quality Preferences for Deciduous Fruit"  
G. A. King, Agricultural Marketing Service, "Some Economic Effects of Supporting Feed Prices"  
Holbrook Working, Stanford University, "New Ideas and Methods for Research on Price Behavior"

**SECTION VI. CHANGING REQUIREMENTS FOR AGRICULTURAL DATA**

- D. D. Brown, Mutual Federation of Independent Cooperatives, Inc., and J. B. Claar, Extension Service, U. S. Department of Agriculture (Washington, D.C.), "Agricultural Data Requirements in Extension Work"  
M. D. Thomas, Oregon State College, "Data Requirements in Agricultural Administration and Research"  
E. C. Wilcox, Agricultural Marketing Service (Seattle), "Local Data Requirements in Areas of High Agricultural Specialization"  
Discussants: G. B. Wood, Oregon State College; N. I. Nielsen, Agricultural Marketing Service (Sacramento)  
8:00 P.M. WFEA Business Meeting

**TUESDAY, AUGUST 28**

- 8:00 to 9:00 A.M. AFEA Business Meeting, and Announcement of Awards  
9:30 A.M. to 12:00 M. General Session

**THE STRATEGY FOR ECONOMIC GROWTH AND STABILITY**

Herbert Stein, Committee for Economic Development, "Policies and Programs to Promote Growth and Stability"

Panel Discussion: "Strategy from the Standpoint of Agriculture"

Panel of Six: O. V. Wells, Agricultural Marketing Service; K. A. Fox, Iowa State College; Marion Clawson, Resources for the Future, Inc.; A. B. Kline, American Farm Bureau Federation

12:00 M. to 2:00 P.M. *Luncheon Session*

H. B. James, North Carolina State College, "Agricultural Economics in the Years Ahead," *AFEA Presidential Address*

2:00 to 4:30 P.M. *Section Meetings*

**SECTION I. CREDIT AND INVESTMENT IN AGRICULTURE**

Eli Ferguson, Equitable Life Assurance Society, "Economic Considerations in Making Long-Term Timber Loans"

F. L. Garlock, Agricultural Research Service, "Financing Adjustments in Farming"

Frank Miller, University of Missouri, "Equity Financing in Agriculture"

Discussants: G. K. Brinegar, University of Connecticut; L. A. Jones, Agricultural Research Service

**SECTION II. CAN WE EXPAND MARKETS FOR FARM PRODUCTS?**

"Economic Bases for Market Development Programs"

"New Techniques in Consumer Preference Research"

"Finding Higher-Use Values for Lower Qualities of Cotton"

**SECTION III. CONTRIBUTIONS OF ECONOMICS IN RANGE ECONOMICS RESEARCH**

J. A. Hopkin, Bank of America, "Use of Economics in Making Decisions Relating to Range Use"

E. O. Heady, Iowa State College, "Use of Economics in Designing Experiments in Forage Production for Grazing"

C. V. Plath, Oregon State College, "Use of Surveys in Economic Research in Forage Production for Grazing"

Discussants: C. B. Baker, Montana State College; P. F. Philipp, University of Hawaii

**SECTION IV. REGIONAL DEVELOPMENT AND TRADE**

W. H. Nicholls, Vanderbilt University, "The Effects of Industrial Development on Southern Agriculture"

V. L. Sorenson, Michigan State University, "Price Support Programs and Interregional Competition"

C. E. Bishop and W. R. Henry, North Carolina State College, "Interregional Competition in Production and Marketing of Broilers"

**SECTION V. AGRICULTURAL POLICY ISSUES**

Sidney Hoos, University of California, "The Impact of Marketing Orders on Competition in Agriculture"

A. H. Turner, Department of Agriculture, Canada, "Canada's Price Support Policy and Its Performance"

C. C. Mitchell, Jr., University of Nebraska, "Shortcomings in Current Explanations of National Farm Surpluses"

Discussants: Helen C. Farnsworth, Stanford University; L. C. Halvorson, The National Grange, T. M. Adams, University of Vermont.

## SECTION VI. FOOD RESEARCH

"The Major Current Problems in Nutrition Research"

Marguerite C. Burk, Agricultural Marketing Service, "Studies of the Consumption of Farm Products and Their Uses"

M. K. Bennett, Stanford University, "Some Problems Raised by the Official Statistics of Food Consumption in the United States"

WEDNESDAY, AUGUST 29

## UNITED STATES TECHNICAL ASSISTANCE TO FOREIGN AGRICULTURE

9:15 to 9:50 A.M. General Session

A. T. Mosher, Cornell University, "A Review and Criticism of United States Efforts to Help Other People Improve Their Agriculture"

10:00 A.M. to 12:00 M. Area Section Meetings

AREA SECTION A. PROBLEMS IN HIGH-POPULATION, HIGH-TECHNOLOGY, LOW-INCOME COUNTRIES (JAPAN, AND PARTS OF WESTERN EUROPE)

Panel of Six: K. L. Bachman, Agricultural Research Service

AREA SECTION B. PROBLEMS IN HIGH-POPULATION, LOW-TECHNOLOGY, LOW-INCOME COUNTRIES (ASIA, EXCLUDING JAPAN)

Panel of Six: C. R. Creek, Colorado A and M College; L. R. Martin, North Carolina State College; L. S. Robertson, Purdue University; J. H. Southern, Agricultural Research Service; C. A. Bratton, Cornell University; M. D. Woodin, Louisiana State University; S. C. Shull, University of Maryland

AREA SECTION C. PROBLEMS IN LOW-POPULATION, LOW-TECHNOLOGY, LOW-INCOME COUNTRIES (AFRICA, LATIN AMERICA, THE MIDDLE EAST)

Panel of Six: L. W. Witt, Michigan State University; W. O. Jones, Stanford University

12:00 M. to 2:30 P.M. Luncheon Session

J. W. Tapp, Bank of America, "The Agricultural Problem"

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## ANNOUNCING THE 1956 DIRECTORY OF THE AMERICAN FARM ECONOMIC ASSOCIATION

THE 1956 Directory will be a "Who's Who" type of handbook, the first issued in the history of the Association. Its preparation is in the hands of a committee composed of R. J. Saville (chairman), S. A. Robert, Jr., H. G. Porter, and A. D. Seale, Jr. This major undertaking will succeed only with the full and prompt cooperation of all who wish to be listed in it. The more complete the coverage is, the more useful this much-needed handbook will be to all of us.

The probable contents of the 1956 Directory will be: (1) Alphabetical list of Association members, including their principal personal and professional data; (2) a classification of members according to fields of specialization; (3) a list of members who have served as advisers to foreign countries (by major areas); (4) a geographical membership list; (5) supplementary reference information including: (a) AFEA administrative officers, 1954-56; (b) roster of AFEA committees for 1956; (c) location of AFEA annual meetings to date; (d) list of affiliated organizations; (e) list of agricultural economists in selected foreign countries; (f) a list of heads of departments of agricultural economics in U. S. colleges and universities, and of directors of other agencies in the United States employing agricultural economists, (g) a directory of U. S. agricultural agencies and related organizations, and (h) a list of the awards offered by the AFEA and of winners of the awards to date.

The Committee for the 1956 Directory is preparing a questionnaire for circulation among all Association members enrolled prior to June 1, 1956. All present members are urged to suggest that non-member colleagues, students, and other candidates for membership apply to the Secretary-Treasurer for enrollment not later than May 31 in order to receive the Directory Questionnaire and to be included in the Directory. Since the next volume of the Directory cannot be issued for several years, and it will be to the advantage of all members listed to have included all the information that the questionnaire requests, prompt cooperation with the Directory Committee is urged.

# THE JOURNAL OF POLITICAL ECONOMY

Edited by ALBERT REES

in Co-operation with the Other Members of the  
*Department of Economics of the University of Chicago*

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The Transfer Problem and Exchange Stability .....	Harry G. Johnson
Economic Stabilization Policy for a Primary-Producing Country .....	Joseph A. Hasson
The Baseball Players' Labor Market .....	Simon Rottenberg
Saving in the United States .....	F. W. Paish
A Note on Grain Output in the Soviet Union .....	A. Kahan
Book Reviews and Books Received	

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The University of Chicago Press • 5750 Ellis Ave., Chicago 37, Ill.

## CANADIAN JOURNAL OF AGRICULTURAL ECONOMICS

Editor: R. B. How  
Ontario Agricultural College, Guelph, Ontario

Volume IV

1956

Number 1

### CONTENTS

Integration of Physical Sciences and Agricultural Economics .....	Earl O. Heady
A Master Frame For Area Samples of Agriculture: Its Usefulness For Collection of Agricultural Statistics .....	Alan D. Holmes
Discussion .....	Bruce A. MacDonald
The Needs and Uses of Agricultural Statistics in Canadian Universities .....	J. C. Gilson
Discussion .....	V. Gilchrist
Discussion .....	H. K. Scott
What Farmers Expect From Economists .....	Roy C. Marler
Discussion .....	Gordon L. Burton
Discussion .....	J. L. Clark
Notes	
Comments on "Surface Water Rights" .....	E. F. Durrant
More About Surface Water Rights .....	D. R. Campbell

### Journal of THE CANADIAN AGRICULTURAL ECONOMICS SOCIETY

This Journal is published twice a year.

Yearly subscription is \$3.00

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